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THE

YOUNG MAN'S

BOOK OF KNOWLEDGE,

CONTAINING

A FAMILIAR VIEW OF THE

Importance of Religion,

THE WORKS OF NATURE,

LOGIC, ELOQUENCE, THE PASSIONS,

MATTER AND MOTION,

MAGNETISM, MECHANICAL POWERS,

Hydrostics, Hydraulics, Optics, Acoustics, Electricity,

GALVANISM,

GEOMETRY, GEOGRAPHY, ASTRONOMY,

HISTORY, CHRONOLOGY, &c.

BY THOMAS TEGG,

Editor of the "Chronology, or Historian's Companion."

EIGHTEENTH EDITION, ENLARGED,

With Treatise on Short-Hand, and a General Index.

"Knowledge is Power." BACON

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TO THE PRESENT EDITION.

THE primary design of this Volume being the extension of useful knowledge, no labour has been spared to compress into a small compass, materials gleaned from a vast variety of sources, and scattered through a number of volumes too extensive for the general and unlearned reader to attempt to peruse. The Editor has endeavoured also to arrange those materials in such a way as might be the most pleasing and attractive. The principles of each science, he likewise flatters himself, are laid down with a simplicity that will require no previous knowledge in the student, nor render their acquisition tiresome, by an abstract and dry detail. In short, every attention has been paid to render these pages worthy the acceptance of the public in general, and of those youths in particular who, in this enquiring age, may be desirous of attaining the Elements of General Knowledge.

Flattered by the reception the work has met with, and desirous of rendering it as complete as possible, the editor has in this edition, added a general Index, for the use of those who may wish to refer occasionally to any particular parts of the volume. This, he hopes, will be found a useful appendage to the work, and a ready key to its contents.

ADVERTISEMENT.

As this publication was originally compiled with the view dividing the profits among seven of the editor's children, y as a reward for their past exemplary conduct, and partly stimulus to future exertions, he has much reason to be ul for the reception it has met with from the public in the sale of the former Editions, as well as in the de- e has been for the present. The price of the volume fixed proportionably low, in order that every youth uated by the desire of acquiring useful knowledge, ave the opportunity of possessing it

January, 1825.

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YOUNG MAN'S

BOOK OF KNOWLEDGE.

CHAP. I.

IMPORTANCE OF RELIGION.

IT is acknowledged that man is superior to brute creatures, and that this superiority consists in his capacity of being much happier in himself, and in his power of contributing in a more eminent degree to the happiness of others; by which means he makes nearer approaches to his Maker, who is supremely benevolent, and superlatively happy.

It is also well known, that this superiority in man, with respect to his power of enjoying and communicating happiness, depends upon the superiority of his mental faculties, by which he is capable of greater comprehension of mind, of taking into his view more of the past and of the future along with the present; so that his ideas are more complex, and farther removed from mere sensible objects. In consequence of this, the happiness of man does not depend upon his present sensations, but is of more stable nature; and his resolutions and actions do not depend upon variable circumstances, but he can pursue an uniform plan of conduct, without being diverted from it by the events of the hour, or of the day.

This superior comprehension of mind cannot, however, in the nature of things, be attained by man without a state

of progressive improvement, beginning with the condition of a brute animal, merely impressed by sensible objects, and impelled to action by those impressions, as children are; because these impressions are the elements of all our knowledge, and of all our powers in future life; and there is no true wisdom in any attempts to accelerate this progress beyond a certain term. For what would a greater comprehension of mind, and a greater power of combining ideas, avail us, without a stock of ideas to combine and comprehend? It is well known, that if we expect that boys should ever make valuable men, they must continue some time in the state of boys, or they will never make men worth forming. In the very warmth and impetuosity, and consequently the occasional irregularities, of youth, we often perceive the germ of the most excellent characters. But then these irregularities of youth, by which their minds are stored with a sufficient variety of strong impressions, must not be continued beyond the season of youth, or that state of peculiar sensibility, in which something still more new shall be able, in a great measure, to lessen the effect of preceding impressions, otherwise habits will be formed which will preclude all farther progress. In a course of time the mind acquires an insensibility to new impressions. A man is then in a manner incapable of extending his views, and thereby he loses the great privilege of his rational nature. His mind, for want of an accession of new ideas, or farther knowledge, may even contract, and he may sink into a state approaching that of a brute animal, and one that is old and intractable.

This, however, we observe by the way, though we shall have some farther use for the observation hereafter; our object being to shew, that for the very same reason that a man excels other animals, a believer in divine revelation, and especially a Christian, is superior to other men; his comprehension of mind being enlarged by such knowledge as revelation brings him acquainted with, so that he is capable of being much more happy in himself, and of a more generous ardour in promoting the happiness of others. Also, being less sensible to present impressions, he will be more drawn out of himself, and be more free from that anxiety and distress to which persons who attend to themselves only are necessarily subject.

It may not be improper to consider as the first great article of revealed religion, because it is by this means more strongly impressed upon the mind, though it is also the dictate of nature, to be the doctrine of the being of a God. It so much stands or falls with the belief of revelation, that at present they generally go together, and they who are unbelievers in revealed religion, though they may retain the belief of a God, have little motive to *attend* to the subject, so that they are generally practical, though not absolutely speculative atheists.

Now the belief, the habitual and practical belief, of the being of God, a Being infinitely wise, powerful, and good, the Author of universal nature, and the doctrine of a Providence, which is connected with it, contributes greatly to the enlargement of the mind of man, extending our views beyond what we immediately see and hear around us. Without this, man is comparatively a being of narrow views, but little advanced beyond the brutes, and has but little motive to attend to any thing beyond himself, and the lowest gratifications. Without this faith he must be liable to be disturbed and unhinged by every cross event.

But the belief of a God, and of a Providence, of a Being who created all things, who has assigned to every creature his proper station, and who superintends the whole chain of events, relieves and enlarges the mind, and also gives us a lively interest in the concerns of others. The idea of a God is that of the father of all his creatures, and especially of all mankind: and this suggests the farther idea, that all men are brethren, the children of one common parent; and with this idea are intimately connected a thousand other pleasing ideas, and especially a sense of a common interest, and an obligation to promote it by every means in our power. With this favourable impression, we are prepared to respect, and to love, all mankind, as brethren, and to bear with one another as such. Whereas, without this idea, we feel as so many unconnected individuals, turned adrift upon the wide world, where we must each of us scramble for ourselves as well as we can, and shall seldom think of attending to others, any farther than a regard to our own interest may make it expedient.

Thus, by means of faith in the being and providence of God, we are nobly carried out of, and beyond, ourselves,

and are led to conceive a generous regard for others; and by this we lose nothing but a mean selfishness, and with it a tormenting anxiety, which is at the same time the characteristic, and the punishment, of a narrow, contracted mind.

There is no true, well founded patriotism, that has any other foundation than this. Without this, there will always be room for suspicion and distrust, a suspicion of private and selfish views, suited to a mind destitute of this great and enlarged principle, of all mankind constituting one family, under one great head; the idea of an universal parent, who regards us all as his children, and who requires that we regard each other in the same pleasing light.

Without faith in God, and a belief of his universal benevolent providence, men must be liable to be peculiarly distressed and disconcerted at such calamitous events as we are daily subject to. They are evils in themselves, and we do not know to what farther evils they may lead. Even the good that we see is uncertain and unstable, and for any thing that we know, may terminate in evil, which it will thereby only serve to aggravate. In this state of mind all is darkness and confusion, anxiety and dread.

But the moment that we begin to consider the world not as a fatherless world, but that there is a principle of wisdom and goodness presiding over all, and believe that nothing can come to pass without the knowledge and intention of this infinite wisdom and goodness, the gloom vanishes, and day light bursts upon us. For though we be still at a loss to account for particular events, and do not distinctly see their tendency to good, our firm persuasion that good *is* intended, and will be the result of the whole scheme, is not at all shaken; and then nothing will remain but a pleasing curiosity with respect to the manner in which the good will be produced. In the midst of calamity we can, with this persuasion, live a life of faith, and of joy.

Thus does the belief of a God and a Providence contribute to make a man a much greater and happier being than he otherwise could be. It enlarges his views of the system of nature, of which he is a part. It discovers to him his connexion with, and his interest in, other beings, and other things. It leads him to look backward to the origin of things, and forward to the termination of the

great drama, and to believe that it will be most glorious and happy.

This end will be much farther promoted by the great doctrine of revelation, that this life is not the whole of our existence; that it is only a state of probation and discipline, calculated to train us up for a future and more glorious state after death. How different, and how superior, a being must this view, properly impressed upon the mind, make a man. It is a difference not easy to describe, but it may be felt. A being of a day will have his views, thoughts, and schemes, adapted to a day. To-morrow cannot interest him, because he has no interest in it. If he like the scenes of the day, to which his existence is confined, his heart must sicken at the idea of any thing beyond it, because he is totally excluded from it.

What then must be the feelings of the man who truly and habitually believes that he is born for eternity; that years and ages bear no sensible proportion to the term of his existence; that the duration of the sun, moon, and stars, is no more than a period that divides his existence, and assists him in measuring it; that when they shall be no more, he only, as it were, begins to be, and that other suns and other worlds will be equally short lived with respect to him. How sublime, and how animating, is the thought. Can any thing mean and sordid occupy the breast of a being who is persuaded of this grand destination? Will he not overlook every thing temporary, and be ever stretching his thoughts to things eternal, in which his interest is infinitely greater than in any thing here?

We think highly, and justly so, of the advantage which an acquaintance with history gives a man over one who has no knowledge of any events besides those of his own times. We are highly gratified in being made acquainted with the origin, and early history, of the country in which we were born, and of the nation to which we belong. We are sensible that *travelling*, and seeing other countries, and other customs, than our own, improves and enlarges the mind. It adds to our stock of ideas, and gives us a greater field for contemplation. It is thereby the means of removing local prejudices, and of lessening the influence of all ideas connected with that of self.

What, then, must it be to be enabled, by the help of revelation, to look so far back as to the origin of the world, to range through all the successive dispensations

of God to man, to contemplate more especially the promulgation of the gospel, and to look forward to that glorious state of things which is to take place in consequence of its universal spread; to look farther still to the resurrection of the dead, and the day of final judgment, followed by a never-ending eternity?

What a fund of great thoughts do these great subjects supply, and how scanty must be the furniture of that man's mind, let him be a philosopher, an historian, a statesman, or whatever else the world can make him, or he can make himself, compared with that of the meanest Christian, to whom these great and extensive views of things are familiar.

The contemplation of such objects as these is sufficient to raise a man above the world, and all the little pursuits and gratifications of it. Will such a man as this bestow much thought on the indulgence of his appetites and passions? Will he envy any man the enjoyment of any thing that this world can give him? or will he have a wish to aggrandize himself or his family in it?

Let us then most seriously exhort the young reader to listen with all earnestness to the sacred commands of the great Founder of Christianity. Continue to embrace with the most unshaken firmness, and to maintain with temperate yet unabating zeal, the religion which he descended from heaven to establish in the world. Recollect that the characteristic tenets of that religion are faith, hope, and charity. Faith does not merely consist in the assent of your judgment to the evidences of Christianity, which are irresistible, but is a pure and lively source of obedience to the divine commands. It is a principle which subdues the pride of human reason, gives to God the glory of our salvation, and to Christ the merit of it. Like a good tree, it may be known by its abundant and excellent fruits; it sanctifies all the moral virtues, and renders them acceptable in the sight of God.—Charity, the bright, the lovely ornament of the Christian character, extends its benign influence to all men, without distinction of country, sect, or opinion; and in its various relations and comprehensive exercise for the good of all, whom it is in our power to benefit, raises us to a resemblance, as far as human nature will allow, of our Father in heaven. To keep the spirit of religion warm and operative in your hearts, maintain a hallowed intercourse with the Almighty by

public and private devotion: to the same end, the perusal of the Holy Scriptures will materially contribute. In them you will find that the Saviour of the World has illustrated his precepts by the most pleasing and striking parables, enforced them by the most awful sanctions, and recommended them by his own greatest and best of all examples. There he unfolds the great mystery of redemption, and communicates the means by which degenerate and fallen man may recover the favour of his offended Maker. He gives a clear view of the divine superintendence of all human affairs; and he represents this mortal life, which forms only a part of our existence, as a short period of warfare and trial. He points to the solemn scenes, which open beyond the grave; the resurrection of the dead, the last judgment, and the impartial distribution of rewards and punishments. He displays the completion of the divine mercy and goodness in the final establishment of perfection and happiness. By making such wonderful and interesting discoveries, let him excite your zeal, and fix your determination to adorn the acquirements of learning and science with the graces of his holy religion, and to dedicate the days of health and of youth to his honour and service. Amid the retirement of study, or the business of active life, let it be your first care, as it is your *duty*, and your *interest*, to recollect, that the great Author and Finisher of your faith has placed the rewards of virtue beyond the reach of time and death, and promised that eternal happiness to the faith and obedience of man, which can alone fill his capacity for enjoyment, and alone satisfy the ardent desires of his soul.

CHAP. II.

WORKS OF NATURE.

IT is the glorious privilege of man, while other animals are confined within the limits which instinct has prescribed, to carry his observations beyond his own immediate wants, and to contemplate the universe at large. He extends his enquiries to all the objects which surround him; exercises his judgment, and informs his understanding, by ascertaining their nature, properties, and uses. In the various branches of the mathematics, in the abstract speculations of metaphysics, or in searching the records of history, he is solely intent on the operations of his own mind, or the actions of himself and his fellow-creatures: but in the study of nature, he examines every object presented to his senses, and takes a general survey of the wide and interesting prospects of the creation. The earth he treads, the ocean he crosses, the air he breathes, the starry heavens on which he gazes, the mines and caverns he explores, all present to him abundant materials for his researches. And, when thus employed, he is engaged in a manner peculiarly suitable to his faculties, since he alone is capable of knowledge, he alone is distinguished by the power of admiration, and exalted by the faculty of reason. The terraqueous globe presents a most glorious and sublime prospect, equally worthy of the capacity of man to contemplate, and beautiful to his eye to behold. And the treasures of nature, which this prospect comprehends, are so rich and inexhaustible, that they may furnish employment for his greatest diligence, stimulated by the most ardent curiosity, and assisted by the most favourable opportunities. At the same time that she solicits him to follow her, not only into her open walks, but likewise to explore her secret recesses, she fails not to reward him with the purest gratifications of the mind, because at every step he takes, new instances of beauty, variety, and perfection, are unfolded to his view. The study of the works of nature is in itself capable of affording the most refined pleasure, and the most edifying instruction. All the objects with which we are surrounded, the smallest as well as the greatest, teach us some useful lesson. All of

them speak a language directed to man, and to man alone. Their evident tendency to some determined end, marks the designs of a great Creator. The volume of creation contains the objects of arts, science, and philosophy, and is open to the inspection of all the inhabitants of the globe. Nature speaks by her works an universal language, the rudiments of which are peculiarly adapted to the inclination and capacity of the young, whose curiosity may be gratified and excited by turns; but more profound and extensive enquiries are suitable to the contemplations of persons of every age; and no subject can be more worthy of their attentive observation.

Whoever opens his eyes, and surveys the creation with the least attention, must perceive a beautiful variety of objects that present themselves to view, and seem to demand his notice. In summer, meadows enamelled with numberless plants and flowers, affording rich pasturage for cattle; fields waving with different kinds of grain for the use of man; woods, forests, plains, and mountains, differently adorned, and ponds, lakes, or winding rivers, varying the charming scene. In winter, the forests naked, nature as it were suspending her productive power; the air severe and piercing, the earth frozen, the waters rendered hard, and capable of bearing men, cattle and carriages; the falling of the fleecy snow, and all the circumstances attending this cold rigorous season; every particular deserves our consideration, and commands inquiry. Look we out at night, when darkness covers and conceals the beauties of our earthly globe, we shall find this temporary loss made up to us by those numberless and glorious stars that glitter in the magnificent canopy hanging over us; and if the moon arises, her mild and friendly rays enlighten the silent scene, and give a fainter day.—In short, whatever the season of the year, whether cheerful spring, warm summer, rich autumn, or cold winter; whatever the hour of the day or night, things worthy of our most serious notice are at hand; things which to know may truly be called learning, and in the study of which an intelligent being may always employ his leisure hours with pleasure. But some kind of method is necessary, to lead the mind at first into a proper train of inquiry. We will therefore proceed step by step, first explaining some of the most common appearances of nature, such as air, water, wind, rain, thunder, &c. then descending in-

to the bowels of the earth, we will give you some knowledge of metals and minerals, such as gold, silver, iron, lead, with many other phenomena, &c.; then wandering over its surface, we will take a view of the vegetable world, and all its beauties, and from thence we will proceed to the animal creation, and survey the insects, birds, fishes, and beasts, and lastly, raise our thoughts, and close the whole with some particular inquiries into the nature and powers of man.

Sect. I.—*Of the Air and Atmosphere.*

The exterior part of this our habitable world, is the air or atmosphere; a light thin fluid, or springy body, that encompasses the solid earth on all sides, and partakes of all its motions, both annual and diurnal.

The composition of that part of our atmosphere, properly called *air*, was till lately but very little known.—Formerly it was supposed to be a simple, homogeneous, and elementary fluid. But the experiments of Dr. Priestley and others have discovered, that even the purest kind of air, which they call vital or dephlogisticated, is in reality a compound, and might be artificially produced in various ways. This dephlogisticated air, however, is but a small part of the composition of our atmosphere. By accurate experiments, the air we usually breathe, is composed of only one-fourth part of this dephlogisticated air, or perhaps less, the other three parts, or more, consisting of what Dr. Priestley calls *phlogisticated*, and M. Lavoisier, in the new chemistry, *mephitic* air, which cannot be breathed, and in which animals die.

Though air seems to be a kind of repository, wherein all the poisonous effluvia arising from putrid and corrupted matters are lodged; yet it has a wonderful facility of purifying itself, and of depositing those vapours contained in it; so that it never becomes noxious except in particular places, and for a short time; the general mass remaining upon all occasions pretty much the same. The way in which this purification is effected is different, according to the nature of the vapour with which the air is loaded. That which most universally prevails is water; and from experiments it appears, that the quantity of aqueous va-

pour contained in the atmosphere is immense. Dr. Halley, from an experiment on the evaporation from a fluid surface heated to the same degree with that given by our meridian sun, has calculated, that the evaporation from the Mediterranean Sea in a summer's day is 5280 millions of tons of water, which is more than it receives from all the nine large rivers that empty themselves into it. Dr. Watson, in his Chemical Essays, has given an account of some experiments made with a view to determine the quantity of water raised from the earth itself alone in time of drought. He informs us, that when there had been no rain for above a month, and the grass was become quite brown and parched, the evaporation from an acre was not less than 1600 gallons in twenty-four hours. Making afterwards two experiments, when the ground had been wetted by a thunder shower the day before, the one gave 1973, the other 1905 gallons, in 12 hours. From this the air is every moment purified by the ascent of the vapour, which, flying off into the clouds, thus leaves room for the exhalation of fresh quantities; so that as the vapour is considerably lighter than the common atmosphere, and in consequence ascends with greater velocity, the air during all this time is said to be *dry*, notwithstanding the vast quantity of aqueous fluid that passes through it.

In the physical economy also, another provision is made for the continual renovation of the atmosphere. Plants derive subsistence from the very air that is unfit for animal life, and in return, actually emit that vital or dephlogisticated air, upon the enjoyment of which the latter depends. Thus we see a constant circulation of benefits maintained between the two great provinces of organized nature. The plant purifies what the animal had poisoned; in return, the contaminated air is more than ordinarily nutritious to the plant. Agitation with water appears to be another of these restoratives. The foulest air shaken in a bottle with water for a sufficient length of time, recovers a great degree of its purity. Here then again, allowing for the scale upon which nature works, we see the salutary effects of *storms* and *tempests*. The yesty waves, which confound the heaven and the sea, are doing the very thing which is done in the bottle and are a perpetual source of freshness to our atmosphere.

The atmosphere, as we have seen, contains a great deal of water, together with a vast heterogeneous collection of particles raised from all bodies of matter on the surface of the earth, by effluvia, exhalations, &c. so that it may be considered as a chaos of the particles of all sorts of matter confusedly mingled together. And hence the atmosphere has been considered as a large chemical vessel, in which the matter of all kinds of sublunary bodies is copiously floating; and thus exposed to the continual action of that immense furnace, the sun; from whence proceed innumerable operations, sublimations, separations, compositions, digestions, fermentations, putrefactions, &c.

There is, however, one substance, namely, the electrical fluid, which is very distinguishable in the mass of the atmosphere. To measure the absolute quantity of this fluid, either in the atmosphere, or any other substance, is perhaps impossible; and all that we know on this subject is, that the electric fluid pervades the atmosphere; that it appears to be more abundant in the superior than the inferior regions; that it seems to be the immediate bond of connection between the atmosphere and the water which is suspended in it; and that, by its various operations, the phenomena of the meteors are occasioned.

It is the opinion of the most celebrated philosophers of the present day, that the electric fluid is no other than the light of the sun; that it issues from that luminary in the pure state of *electricity*, that joining particles of our atmosphere, it becomes *light*, and uniting with the grosser earth, *fire*. The evaporation of water is attended with an absorption of this fluid from the surface of our globe, and on the other hand, the conversion of steam into water, is attended with a deposition of this subtle fluid; so that there is a circulation in the electric fluid as there is in the water. It descends originally from the sun; pervades the whole substance of the globe; and perspiring, as it were, at every pore, ascends beyond the clouds; and passing the extreme boundaries of our atmosphere, returns to the sun from whence it came.

The uses of the atmosphere are so many and great, that it seems indeed absolutely necessary, not only to the comfort and convenience of men, but even to the existence of all animal and vegetable life, and to the very constitution all kinds of matter whatever, and without which they

would not be what they are; for by it we live, breathe, and have our being; and by insinuating itself into all the vacuities of bodies, it becomes the great spring of most of the mutations here below, as generation, corruption, dissolution, &c. and without which none of these operations could be carried on. Without the atmosphere, no animal could exist, or indeed be produced; neither any plant, all vegetation ceasing without its aid; there would be neither rain nor dews to moisten the face of the ground; and though we might perceive the sun and stars like bright specks, we should be in utter darkness, having none of what we call day light, or even twilight; nor would either fire or heat exist without it. In short, the nature and constitution of all matter would be changed and cease; wanting this universal bond and constituting principle.

As to the *weight* and *pressure* of the air, it is evident that the mass of the atmosphere, in common with all other matter, must be endowed with weight and pressure; and this principle was asserted by almost all philosophers, both ancient and modern. But it was only by means of the experiments made with pumps and the barometrical tube, by Galileo and Torricelli, that we came to the proof, not only that the atmosphere is endued with a pressure, but also what the measure and quantity of that pressure is. Thus it is found, that the pressure of the atmosphere sustains a column of quicksilver, in the tube of the barometer, of about thirty inches in height; it therefore follows, that the whole pressure of the atmosphere is equal to the weight of a column of quicksilver, of an equal base, and thirty inches in height; and, because a cubical inch of quicksilver is found to weigh nearly half a pound avoirdupoise, therefore the whole thirty inches, or the weight of the atmosphere on ever square inch of surface is equal to 15lb. Again, as it has been found that the pressure of the atmosphere balances in the case of pumps, &c. a column of water of about 34½ feet high; and, the cubical foot of water weighing just 1000 ounces or 62½lb. 34½ times 62½, or 2158lb. will be the weight of the column of water, or the atmosphere, on a base of a square foot, and consequently the 144th part of this, or 15lb. is the weight of the atmosphere on a square inch, the same as before. Hence Mr. Cotes computed that the pressure of this ambient fluid on the whole surface of the

earth, is equivalent to that of a globe of lead of sixty miles in diameter. And hence also it appears, that the pressure upon the human body must be very considerable; for as every square inch of surface sustains a pressure of 15lb. every square foot will sustain 144 times as much, or 2160lb. then, if the whole surface of a man's body be supposed to contain fifteen square feet, which is pretty near the truth, he must sustain 15 times 2160, or 32400lb. that is, near 14½ tons weight for his ordinary load. By this enormous pressure we should undoubtedly be crushed in a moment, if all parts of bodies were not filled either with air or some other elastic fluid, the spring of which is just sufficient to counterbalance the weight of the atmosphere. But, whatever this fluid may be, it is certain, that it is just able to counteract the weight of the atmosphere, and no more; for if any considerable pressure be superadded to that of the air, as by going into deep water, or the like, it is always severely felt, let it be ever so equable, at least when the change is made suddenly; and if, on the other hand, the pressure of the atmosphere be taken off from any part of the human body, as the hand for instance, when put over an open receiver, from whence the air is afterwards extracted, the weight of the external atmosphere then prevails, and we imagine the hand strongly sucked down into the glass.

The difference in the weight of the air which our bodies sustain at one time more than another, is also very considerable, from the natural changes in the state of the atmosphere. This change takes place chiefly in countries at some distance from the equator; and, as the barometer varies at times from twenty eight to thirty one inches, or about one-tenth of the whole quantity, it follows, that this difference amounts to about a ton and a half on the whole body of a man, which he therefore sustains at one time more than at another. On the increase of this natural weight, the weather is commonly fine, and we feel ourselves what we call braced, and more alert and active; but, on the contrary, when the weight of the air diminishes, the weather is bad, and people feel a listlessness and inactivity about them. And hence it is no wonder, that persons suffer very much in their health, from such changes in the atmosphere, especially when they take place very suddenly.

The weight of the atmosphere has great influence on a number of physical phenomena. It compresses all bodies, and opposes their dilatation. It is an obstacle to the evaporation of fluids. The water of the sea is by this cause preserved in its liquid state, without which it would take the vaporous form, as we see in the vacuum of the air pump. The pressure of the air on our bodies preserves the state both of the solids and fluids; and from the want of this due pressure it is that on the summits of lofty mountains the blood often issues from the pores of the skin, or from the lungs.

Various attempts have been made to ascertain the *height* to which the atmosphere is extended all round the the earth. These commenced soon after it was discovered, by means of the Toricellian tube, that air is endued with weight and pressure. And had not the air an elastic power, but were it every where of the same *density*, from the surface of the earth to the extreme limit of the atmosphere, like water, which is equally dense at all depths, it would be a very easy matter to determine its height from its density, and the column of mercury it would counterbalance in the barometer tube: for, it having been observed, that the weight of the atmosphere is equivalent to a column of thirty inches, or 2½ feet of quicksilver, and the density of the former to that of the latter, as 1 to 11040; therefore the height of the uniform atmosphere would be 11040 times 2½ feet, that is, 27000 feet, or little more than 5¼ miles. But the air, by its elastic quality, expands and contracts; and it being found, by repeated experiments in most nations of Europe, that the spaces it occupies, when compressed by different weights, are reciprocally proportional to those weights themselves; or, that the more the air is pressed, so much the less space it takes up; it follows, that the air in the upper regions of the atmosphere must grow continually more and more rare, as it ascends higher; and, indeed that, according to that law, it must necessarily be extended to an indefinite height. At the height of 3½ miles, the density of the atmosphere is nearly 2 times rarer than it is at the surface of the earth; at the height of seven miles, 4 times rarer, and so on, according to the following table.

Height in miles.	*Number of times rarer.*
3½	2
7	4
14	16
21	64
28	256
35	1024
42	4096
49	16384
56	65536
63	262144
70	1048576

By pursuing these calculations, it might be easily shewn that a cubic inch of the air we breathe would be so much rarefied at the height of 500 miles, that it would fill a sphere equal in diameter to the orbit of Saturn. Hence we may perceive how very soon the air becomes so extremely rare and light, as to be utterly imperceptible to all experience; and that hence, if all the planets have such atmospheres as our earth, they will, at the distances of the planets from one another, be so extremely attenuated, as to give no sensible resistance to the planets in their motion round the sun for many, perhaps hundreds or thousands of ages to come. Even at the height of about fifty miles, it is so rare as to have no sensible effect on the rays of light.

Mr. Boyle, in his physico-mechanical experiments concerning the air, declares it probable, that the atmosphere may be several hundred miles high; which is easy to be admitted, when we consider, what he proves in another part of the same treatise, viz. that the air here about the surface of the earth, when the pressure is taken from it, dilates into 10,000, and even at last into 13,679 times its space; and this altogether by its own expansive force, without the help of fire. In fact, it appears, that the air we breathe is compressed by its own weight into at least the 13,679th part of the space it would possess in *vacuo*. But if the same air be condensed by art, the space it would take up when most dilated, to that it possesses when condensed, will be according to the same author's experiments, as 550,000 to 1.

Our direct experiments, however, not reaching to any great heights into the regions of the atmosphere, and not knowing how far air may be expanded, we are incapable of determining to what height the atmosphere is actually extended.

Sect. II.—*Of the Meteors.*

We have seen that the atmosphere is a vast laboratory, in which nature operates immense analysis, solutions, precipitations, and combinations; it is a grand receiver, in which all the attenuated, volatilized productions of terrestrial bodies are received, mingled, agitated, combined, and separated. Considered in this view, the atmospheric air is a chaos, an indeterminate mixture of mineral, vegetable, and animal affluvia, which the electric fluid is pervading and traversing continually. The grand changes it experiences, and of which we are sensible in extensive spaces by the appearance of water, light, or noise, are called meteors. As the state of the atmosphere is ever varying, the meteors assume different forms; some delighting us with their appearance, while others wear a terrifying aspect. In this repository is collected the gentle dew and hoar frost; here clouds are gathered and carried along by the wind, to refresh the earth in falling showers, give rise to rivers, spread vast inundations of water over the fields, or lay them under a covering of snow or hail; here mock-suns, mock-moons, halos, and rainbows, make their gaudy but transitory appearance; and here the water-spout, dreadful to the mariner; here rolls the dreadful thunder, here lightnings dart their vivid flames, and sometimes striking upon the earth, destroy its productions, fill its inhabitants with terror, and sometimes strike them dead; here the *auroræ*, or streamers, the *ignes fatui*, or wandering fires, called also Jack with the Lantern; here falling stars, as they are ignorantly termed, or fiery balls of various sizes, appear with splendour during the gloom of night, and astonish mankind, who too often seem willing, with superstitious awe, to find portentious omens of dire calamities in those curious phenomena, rather than investigate their causes, or discover their uses.

To account for these various appearances in a satisfactory manner, it is plain that we ought to have an intimate acquaintance with the constitution of the atmosphere; with the nature of those powerful agents by which it appears to be principally influenced, viz. fire, light, and electric fluid; and with their peculiar modes of operation and action upon one another, and upon the atmosphere, and this in every possible variety of circumstances. Nor is even all this sufficient: the various phenomena of rain, wind, snow, thunder, heat, cold, &c. are known to depend very much upon the situation of different places on the surface of the earth; and their occasional variations are, with great reason, *suspected* to proceed, partly at least, from changes which take place in the bowels of the earth: whence we ought not only to be perfectly well acquainted with geography, but with mineralogy also; and that to an extent at which human knowledge will probably never arrive.

In a subject so very difficult, it is not to be supposed that any thing like a certain and established theory can be laid down in this elementary work. As evaporation, however, seems to be particularly concerned in the production of the meteors, we shall take a view of that operation of nature, the extent of which we have noticed in the preceding section. This process may be reckoned in a particular manner the effect of heat. Upon this principle, vapour is shewn to be a compound of water and fire; and such it is supposed to be by philosophers of the highest rank. In considering this operation, however, as carried on by nature, we shall soon find, that it proceeds in a manner very different from what takes place in our chemical operations. In the latter, evaporation is merely the effect of heat; and the process cannot go on without a considerable degree of it. In the natural way, on the contrary, the process goes on under almost every degree of cold we know; the vapours ascend to a height which has never yet been determined; and, from the extreme cold which they sustain, shew evidently that they are connected with our atmosphere by means of some other agent besides heat. From the continual ascent of vapour, indeed, if the operations of nature were of the same kind with those of art, the upper parts of our atmosphere would be always involved in a fog, by reason of the condensation of the vast quantity which continual-

ly ascends thither: but so far is this from being the case, that in those elevated regions to which the vapours continually ascend, the air is much drier than at the surface of the ground.

From many experiments, indeed, it is evident, that water, after being reduced into a state of vapour, is capable of undergoing a certain change, by which it lays aside its fluidity entirely, and even to appearance its specific gravity: so that it becomes, as far as we can judge, a substance totally different from what it was before. After water has attained to this state, our enquiries concerning it must in a great measure cease; but as it is not in the immediate product of evaporation that rain has its source, and as vapours change their nature in the atmosphere, so as to be no longer sensible to the hygrometer, or to the eye, and do not become vapour again till clouds appear, we must acknowledge it to be very probable, that the intermediate state of vapour is no other than air; and that the clouds do not proceed from any distinct fluid in the atmosphere, but from a decomposition of a part of the air itself, perfectly similar to the rest.

Granting this to be the case, and we can scarcely hope for a more probable conjecture on the subject, the decomposition of the vapour will be easily accounted for.—If by any natural process the water can be converted into air, and if the latter is only water partially decomposed; then, by an inversion of the process, air may be instantly re-converted into water, and will become visible in fog or mist, or be condensed into rain, consisting of greater or smaller drops, according to the degree to which this inverted process is carried.

It is generally supposed by meteorologists, from all the clouds, fogs, hail, rain, and snow, being electrified, that the electric fluid is the agent employed in the formation of these meteors, and that it is this fluid which acts in the re-conversion of air into water. This process may be particularly observed in the summer season, when the horizon is suddenly overcast, and a copious torrent of rain ensues, which cannot be from the rising of any aqueous vapours at the time, but must be from a precipitation of water that existed in an invisible state in the atmosphere.

Water may therefore exist in air: 1st, in an invisible state, which is the case when the dissolving power of air

is considerable; 2dly, in a state of incipient separation, in which case it forms *clouds*, *mists*, or *fogs*; 3dly and lastly, in a state of actual separation, in which case it forms either *rain*, properly so called, or *snow*, or *hail*.

Clouds are those well-known assemblages of vapours that float in the atmosphere; have different degrees of opacity, which arise from their extent and density; and generally have pretty well defined boundaries. Their height above the surface of the earth (we mean not above the mountains) is various, but hardly ever exceeds a mile or a mile and a half. In hot weather or hot climates, the clouds, being more rarefied, are lighter, and ascend much higher than they do in colder climates, or colder weather: and indeed, in cold weather, the clouds frequently touch the very surface of the earth; for a fog may with propriety be called a cloud close to the ground.

A *mist* is a very indefinite word. It means an incipient formation of clouds, or haziness; and it often denotes a very small rain, or a deposition of water in particles so small as not to be visible singly.

The *snow* is formed when the atmosphere is so cold as to freeze the particles of rain as soon as they are formed; and the adherence of several of those particles to each other, which meet and cling to each other as they descend through the air, forms the usual fleeces of snow, which are larger (since they are longer in descending, and have a greater opportunity of meeting) when the clouds are higher than when they are lower.

The *hail* differs from snow in its consisting of much more solid, and much more defined pieces of congealed water. It is supposed that the water, already formed into considerable drops, is driven and detained a considerable time through a cold region of the atmosphere by the wind, which almost always accompanies a fall of hail. But the globes of ice, or *hail-stones*, in a fall of hail, sometimes far exceed the usual size of the drops of rain; which shews that, by the action of the wind, the congealed particles must be forced to adhere to each other; and, in fact, though the small hail-stones were more uniformly solid and globular, the large ones almost always consist of a harder nucleus, which is surrounded by a softer substance, and sometimes by various distinct pieces of ice,

just agglutinated. Their shape is seldom perfectly globular.

The phenomena of *dew* and *hoar-frost* seem to proceed from a quantity of aqueous and undecomposed vapour which always exists in the atmosphere, and which, being raised by mere heat, is condensed by mere cold, without undergoing that process by which water is changed into air.

If the cold be very intense, hoar-frost appears instead of dew, which is nothing more than the dew frozen after it falls upon the ground, in the same manner that the vapour in a warm room congeals on the inside of the windows in a frosty night.

Lightning is found to be a flash, produced by the electrical fluid rushing from one part into another; and *thunder*, the sound of the rushing torrent, reverberated among the clouds.—The *aurora borealis*, or northern dawn, is likewise an electrical phenomenon. It is a lambient or flashing light, seen at night in some periods more often than in others, especially about the poles.—The *fiery balls*, which are seen shooting through the atmosphere in the night, of various magnitudes and of different forms, seem all to rise from inflammable vapours, taking fire from their fermenting, or effervescing in the air.

The *rainbow* is one of the most surprising of the works of God, which the Hebrews called the Bow of God, and the Greeks the Daughter of Wonder. This phenomenon is seen in the falling rain or dew, and not in the cloud whence that rain or dew proceeds; it is caused by a reflection and refraction of the sun's rays from the globular particles of rain. The face of this beautiful iris, or bow, is tinged with all the promogenial colours in their natural order; viz. *violet*, *indigo*, *blue*, *green*, *yellow*, and *red*. It always appears in that part of the heavens opposite the sun.

The *halos* are circles somewhat akin to the rainbow, which appear about the sun and moon, and are sometimes variously coloured. They never appear in a rainy sky, but in a rimy and frosty one; and are formed by the refraction of the rays of light, without any reflection, as in the rain-bow.

Mock-suns and *mock-moons* are representations of the face of the true sun and moon by reflection in the clouds.

The weight and pressure of the atmospherical air have been explained in the preceding section. We shall now examine the particulars relative to its progressive motion, which we denominate *wind*.

Wind is a stream or current of air. As the air is a fluid, its natural state is that of rest, which it endeavours always to keep or retrieve by an universal equilibrium of all its parts. When, therefore, this natural equilibrium of the atmosphere happens by any means to be destroyed in any part, there necessarily follows a motion of all the circumjacent air towards that part, to restore it; and this motion of the air is what we call *wind*.

Hence, with respect to that place where the equilibrium of the air is disturbed, we see the wind may blow from every point of the compass at the same time; and those who live northwards of that point have a north wind; those who live southwards, a south wind; and so of the rest: but those who live on the spot where all these winds meet and interfere, are oppressed with turbulent and boisterous weather, whirlwinds, and hurricanes; with rain, tempest, lightning, thunder, &c.

Many are the particular causes which produce wind by interrupting the equipoise of the atmosphere; but the most general causes are two, viz. heat, which, by rarefying the air, makes it lighter in some places than it is in others; and cold, which, by condensing it, makes it heavier. Hence it is, that in all parts over the torrid zone, the air, being more rarefied by a greater quantity of the solar rays, is much lighter than in the other parts of the atmosphere, and most of all over the equatorial parts of the earth. And since the parts at the equator are most rarefied which are near the sun; and those parts are, by the earth's diurnal rotation eastward, continually shifting to the west; it follows, that the parts of the air which lie on the west side of the point of greatest rarefaction, and, by flowing towards it, meet it, have less motion than those parts on the east of the said point, which follow it; and therefore the motion of the eastern air would prevail against that of the western air, and so generate a continual east wind, if this were all the effect of that rarefaction. But we are to consider, that as all the parts of the atmosphere are so greatly rarefied over the equator, and all about the poles greatly condensed by extreme cold, this heavier air from either pole is constantly flowin[illegible]

wards the equator, to restore the balance destroyed by the rarefaction and levity of the air over those regions; hence, in this respect alone, a constant north and south wind would be generated.

Now it is easy to understand, that, by a composition of these two directions of the air from the east and north, a constant north-east wind will be generated in the northern hemisphere, and a constant south-east wind in the southern hemisphere, to a certain distance on each side the equator, all round the earth. And this case we find to be verified in the *general trade winds*, which constantly blow from the north-east and south-east, to about thirty degrees on each side the equator, where those parts are over the open ocean, and not affected with the reflection of the sun-beams from the heated surface of the land; for in this case the wind will always set in upon the land, as on the coast of Guinea, and other parts of the torrid zone, we know it does.

The temperature of a country, with respect to heat or cold, is increased or diminished by winds, according as they come from a hotter or colder part of the world. The north and north-easterly winds, in this country and all the western parts of Europe, are reckoned cold and drying winds. They are cold, because they come from the frozen region of the north pole, or over a great tract of cold land. Their drying quality is derived from their coming principally over land, and from a well-known property of the air, namely, that warm air can dissolve, and keep dissolved, a greater quantity of water than colder air: hence the air which comes from colder regions, being heated over warmer countries, becomes a better solvent of moisture, and dries up with greater energy the moist bodies it comes in contact with; and, on the other hand, warm air coming into a colder region deposits a quantity of the water it kept in solution, and occasions mists, fogs, clouds, rains, &c.

In warm countries sometimes the winds, which blow over a great tract of highly heated land, become so very drying, scorching, and suffocating, as to produce dreadful effects. These winds, under the name of *solanos*, are often felt in the deserts of Arabia, in the neighbourhood of the Persian gulph, in the interior of Africa, and in some other places. There are likewise in India, part of China, part of Africa, and elsewhere, other winds, which deposit

so much warm moisture as to soften, and actually to dissolve glue, salts, and almost every article which is soluble in water.

It is impossible to give any adequate account of irregular winds, especially of those sudden and violent gusts as come on at very irregular periods, and generally continue for a short time. They sometimes spread over an extensive tract of country, and at other times are confined within a remarkably narrow space. Their causes are by no means rightly understood, though they have been vaguely attributed to peculiar rarefactions, to the combined attractions of the sun and moon, to earthquakes, to electricity, &c. They are called in general *hurricanes*, or they are the principal phenomenon of a hurricane, that is, of a violent storm.

Almost every one of those violent winds is attended with particular phenomena, such as droughts, or heavy rains, or hail, or snow, or thunder and lightning, or several of those phenomena at once. They frequently shift suddenly from one quarter of the horizon to another, and then come again to the former point. In this case they are called *tornadoes*.

In some parts of the Indian ocean there are winds which blow one way during one half of the year, and then blow the contrary way during the other half of the year. These winds are called *monsoons*, and owe their origin to causes similar to what has been pointed out.

When the gusts of wind come from different quarters at the same time, and meet in a certain place, there the air acquires a circular, or rotatory, or screw-like motion, either ascending or descending, as it were, round an axis; and this axis sometimes is stationary, and at other times moves on in a particular direction. This phenomenon, which is called a *whirlwind*, gives a whirling motion to dust, sand, water, part of a cloud, and sometimes even to bodies of great weight and bulk, carrying them either upwards or downwards, and lastly scatters them about in different directions.

The *water-spout* has been attributed principally, if not entirely, to the meeting of different winds. In that case the air in its rotation acquires a centrifugal motion; whence it endeavours to recede from the axis of the whirl; in consequence of which a vacuum, or at least a considerable rarefaction of air, takes place about the axis, and,

when the whirl takes place at sea, or upon water, the water rises into that rarefied place; for the same reason which causes it to ascend into the exhausted tube, and forms the water-spout, or pillar of water, in the air. The water-spouts generally break about their middle, and the falling waters occasion great damage, either to ships that have the misfortune of being under them, or to the adjoining land; for such spouts are sometimes formed on a lake or river, or on the sea close to the land.

As the motion of the air has a greater or lesser velocity, the wind is stronger or weaker; and it is found from observation, that the velocity of the wind is various, from the rate of 1 to 100 miles per hour.

The following particulars respecting the velocity, &c. of the wind are extracted from a table which appeared in the 51st volume of the Philosophical Transactions, by Mr. J. Smeaton, the celebrated engineer.

When the velocity of the wind is one mile per hour, it is hardly perceptible.

From 2 to 3,	just perceptible.
4 — 5,	gentle, pleasant wind, or breezes.
10 — 15,	pleasant, brisk gale
20 — 25,	very brisk.
30 — 35,	high winds.
40 — 45,	very high.
50 miles per hour,	a storm or tempest.
60 . . .	a great storm.
80 . . .	a hurricane.
100 . . .	a hurricane that tears up trees, carries buildings before it, &c.

The winds are of immense and indispensable use. Besides their more obvious effects in driving of ships, windmills, &c. they preserve, by mixing, the necessary purity of the air. The winds likewise drive away vapours, clouds, fogs, and mists, from those parts in which they are copiously formed, to others which are in want of moisture; and thus the whole surface of the earth is supplied with water. It is the winds that diminish the heat, and augment the moisture of the torrid zone; and produce contrary effects on those of the polar regions; so as to render those districts of the globe, which the ancients deemed totally unfit for the abode of man, and other

animals, by reason of excessive heat, not only habitable, but salutary and pleasing to man and beast, and yielding great variety and abundance of the choice productions of nature.

Sect. III.—*Of Springs, Rivers, and the Sea.*

Having viewed water as it takes its departure from the bosom of the deep, and forms the watery meteors, we shall now survey it as it rises in the salient spring, and gives birth to the gurgling rill, or uniting, gives coolness to the landscape in the magnificent stream, that in its ample range fertilizes its neighbourhood.

Various have been the theories, or rather hypotheses, relating to the origin of springs; but it seems the general opinion of those who have made this branch of natural philosophy their study, that the true principles which supply the waters of fountains or springs, are melted snow, rain water, and condensed vapours.

The prodigious quantity of vapours raised by the sun's heat, and otherwise, being carried by the winds over the low lands to the very ridges of mountains, as the Pyrenean, the Alps, the Apennine, the Carpathian, in Europe; the Taurus, the Caucasus, Imaus, and others, in Asia; Atlas, the Montes Lunæ, or mountains of the moon, with other unknown ridges in Africa; the vapours being compelled by the stream of air to mount up with it to the top of those mountains, where the air becoming too light to sustain them, and condensed by cold, they strike against their summits, which causes an union of their particles, and are precipitated in water, which gleets down by the crannies of the stone, and entering into the caverns of the hills, gathers, as in an *alembic*, into the basons of stone it finds, which being once filled, all the overplus of water that comes thither, runs over by the lowest places, and breaking out by the sides of the hills, forms single *springs*.

Many of these springs running down by the vallies, between the ridges of the hills, and coming to unite, form little *rivulets*, or *brooks*: many of these again meeting in one common valley, and gaining the plain ground, being

grown less rapid, become a *river;* and many of these being united in one common channel, make such enormous streams as the Rhine, the Rhone, and the Danube. And it may always pass for a rule, that the magnitude of a river, or the quantity of water it discharges, is proportional to the length and heights of these very ridges from whence the fountains arise.

The several sorts of springs observed are *common springs*, which either run continually, and then they are called *perennial springs;* or else run only for a time, or at certain times of the year, and then they are called *temporary springs. Intermitting springs*, or such as flow and then stop, and flow and stop again, by regular alternations or intermissions. *Reciprocating springs*, whose waters rise and fall, or flow and ebb, by regular intervals, or reciprocations of the surface.

If these reservoirs of water in the bodies of mountains be situated where mineral ores abound, or the ducts or feeding streams run through mineral earth, it is easy to conceive the particles of metal will mix with, and be absorbed by the water, which, being saturated therewith, becomes a *mineral spring* or *well.* If salt, sulphur, and lime-stone abound in the strata through which the water passes, it will then be saline, sulphureous, and lime-water. If sulphur and iron should both abound in the parts of the hill whence the waters come, the waters will partake of the warmth or heat which is occasioned by the mixture of two such substances in the earth, where they are found.

Having noticed the different kinds of springs, we shall say a few words respecting the various phenomena which take place in rivers.

A large collection of water which runs in consequence of its gravity from a higher to a lower part of the surface of the earth, in a channel generally open at top, is called a *river.*

A river which flows uniformly, and preserves the same height in the same place, is said to be in a *permanent state;* such rivers are very rare.

The water of a river does not flow with the same velocity through the whole width of the river. The line in which the water moves with the greatest velocity is called *the thread of the river;* and this thread seldom lies in the

middle of the river, but it generally comes nearer to one side than the other, according to the nature of the impediments, and the configuration of the banks. The velocity of rivers is likewise less at the bottom of their channels than at their surface, owing to the resistance which the bed makes to the water as it flows.

The running of rivers is upon the same principle as the descent of bodies on inclined planes; for water no more than a solid can move on a horizontal plane, the re-action of such a plane being equal and contrary to gravity, entirely destroys it, and leaves the body at rest; here we speak of a plane of small extent, and such as coincides with the curved surface of the earth. But if we consider a large extent or long course of water, then we shall find that such water can never be at rest but when the bottom of the channel coincides everywhere with the curved surface of the earth. In rivers that are made it is usual to allow the fall of 1 foot in 300, but the declivity of those formed by nature is various and uncertain.

The velocity of the water of a river ought to increase in proportion as it recedes from its source: but the numerous causes of retardation, which occur in rivers, are productive of very great irregularities; and it is impossible to form any general rules for determining such irregularities.

The unequal quantities of water (arising from rains, from the melting of snow, &c.) which are conveyed by rivers at different seasons, enlarge or contract their widths, render them more or less rapid, and change more or less the form of their beds. But independent of this, the size and form of a river is liable to be continually altered by the usual flowing of its waters, and by local peculiarities. The water constantly corrodes its bed wherever it runs with considerable velocity, and rubs off the sand, or other not very coherent parts. The corrosion is most remarkable in that part of the bottom, which is under the *thread* of the river, or where the water descends suddenly from an eminence, as in a *cascade* or *water-fall.* The sand thus raised is deposited in places where the water slacks its velocity; and there, by degrees, an obstacle, a bank, and even an island, is formed, which in its turn produces other changes. Thus a river sometimes forms itself a new bed, or it overflows the adjacent grounds.

In some places we find that an obstacle, or a bent on one side, will occasion a corrosion on the opposite bank, by directing the impetus of the stream towards that bank. Thus, from divers causes, whose concurrence in different proportions, and at different times, forms an infinite variety, the velocity of rivers is never steady or uniform.

The following curious calculation respecting the river Thames was made by Dr. Halley. In order to estimate the quantity of water, which passes daily through the Thames, the Doctor assumes the breadth of the river at Kingston bridge (where the flood seldom reaches) to be 100 yards, and the depth 3: so that the section of the channel is 300 square yards, and allowing the velocity of the water to be at the rate of 2 miles per hour, there will run in 24 hours, the length of 48 miles, or 84480 yards; therefore 84480 + 300 = 25,344,000 cubic yards, which make 203,000,000 tons which the river Thames yields per diem.

The proportional lengths of course of some of the most noted rivers in the world are shewn nearly by the following numbers, extracted from Mr. Rennel's paper, 71st vol. Phil. Trans.

European Rivers.

Thames	1
Rhine	5¼
Danube	7
Wolga	9½

Asiatic Rivers.

Indus	6¾
Euphrates	8½
Ganges	9½
Burrampooter	9½
Non Kian, or Ava River	9½
Jennisea	10
Oby	10½
Amoor	11
Lena	11½
Hoanho (of China)	13½
Kian Keu (of ditto)	15¾

African River.

Nile	12¼

American Rivers.

Mississippi	8
Amazons	15⅝

When we reflect on the immense length of these rivers, and their origin, we are naturally directed to the contemplation of the round which water travels; and by which, without suffering adulteration or waste, it is continually offering itself to the wants of the habitable globe. From the sea are exhaled those vapours which form the clouds; these clouds descend in refreshing showers of rain, which sinking deep into the earth, form springs, and springs uniting, form rivers, which rivers in return feed the ocean. So there is an incessant circulation of the same fluid; and not one drop probably more or less now than there was at the creation. In fact, " look nature through 'tis revolution all;" wherever we turn our eyes, all seem continually in a state of change or circulation. "The sun," saith Solomon, " ariseth, and the sun goeth down, and pants for the place from whence he arose; all rivers run into the sea, yet the sea is not full; unto the place from whence the rivers came, thither they return again."

The *sea* is a vast collection of waters in the deep and unfathomable valleys of the earth. This great abyss occupies nearly three quarters of the whole surface of our globe; which has been thought by some too great a proportion; but it is probable no more than sufficient to fertilize the land.

The saltness of the sea is a property in that element, which appears to have excited the curiosity of naturalists in all ages. This property is very rationally judged to arise from great multitudes both of mines and mountains of salt, dispersed here and there in the depths of the sea; the salt being continually diluted and dissolved by the waters, the sea becomes impregnated with its particles throughout; and, for this reason, the saltness of the sea can never be diminished.

The saltness of the sea preserves its waters pure and sweet, which otherwise would corrupt and stink like a filthy lake, and consequently none of the myriads of creatures which now live therein, could then have being; from hence, also, the sea-water becomes much heavier; and, therefore, ships of greater size and quantity may be used thereon. Salt water also doth not freeze as soon as fresh water, whence the seas are more free for navigation.

The most remarkable thing in the sea, is that motion of the water called *tides*. It is a rising and falling of the water of the sea. The cause of this is the attraction of the moon, whereby the part of the water in the great ocean, which is nearest the moon, being most strongly attracted, is raised higher than the rest; and the part opposite to it, on the contrary side, being least attracted, is also higher than the rest. And these two opposite rises of the surface of the water in the great ocean, following the motion of the moon from east to west, and striking against the large coasts of the continents that lie in its way, from thence rebounds back again, and so makes floods and ebbs in narrow seas, and rivers remote from the great ocean.

As the earth, by its daily rotation round its axis, goes from the moon to the moon again, (or the moon appears to move round the earth from a given meridian to the same again) in about 24 hours, hence in that period there are two tides of flood, and two of ebb, and this alternate ebbing and flowing continues without intermission. For instance, if the tide be now high water mark, in any port, or harbour, which lies open to the ocean, it will presently subside, and flow regularly back, for about six hours, when it will be found at low water-mark. After this, it will again gradually advance for six hours, and then return back, in the same time, to its former situation; rising and falling alternately, twice a-day, or in the space of about twenty-four hours.

The interval between its flux and reflux is, however, not precisely six hours, but about eleven minutes more; so that the time of high water does not always happen at the same hour, but is about three quarters of an hour later every day, for thirty days; when it again recurs as before. For example, if it be high water at any place to-day at noon, it will be low water at eleven minutes after six in

the evening; and, consequently, after two changes more, the time of high water the next day will be about three quarters of an hour after noon; the day following it will be at about half an hour after one; the day after that at a quarter past two; and so on for thirty days; when it will again be found to be high water at noon, the same as on the day the observation was first made. And this exactly answers to the motion of the moon; she rises every day about three quarters of an hour later than upon the preceding one; and, by moving in this manner round the earth, completes her revolution in about thirty days, and then begins to rise again at the same time as before.

To make the matter still plainer: suppose, at a certain place, it is high water at about three o'clock in the afternoon upon the day of the new moon; the following day it will be high water at about three quarters of an hour after three; the day after that at about half an hour past four, and so on, till the next new moon; when it will again be high water about three o'clock, the same as before. And by observing the tides continually at the same place, they will always be found to follow the same rule; the time of high water, upon the day of every new moon, being nearly at the same hour; and three quarters of an hour later every succeeding day.

The attraction of the sun also produces a similar rising and falling of the water of the ocean, but on account of its distance, not near so considerable as that which is produced by the moon. It will be readily understood, that according to the different situations of the sun and the moon, the tides which are raised by their respective attraction, will either conspire with, or counteract each other in a greater or lesser degree. When they conspire together the tides rise higher, and their mutual action produces what are called *spring tides*. On the contrary, when they counteract each other, they produce *neap tides*.

From a slight consideration of what has been said, we might be led to imagine, that the time of high water at any place, would be when the moon is over the meridian of that place. But this is by no means the case; it being usually about three hours afterwards; the reason of which may be shown as follows: The moon, when she is on the meridian, or nearest to the zenith of any place, tends to raise the waters at that place; but this force must evidently be exerted for a considerable time, before the greatest

elevation will take place; for if the moon's attraction were to cease altogether, when she has passed the meridian, yet the motion already communicated to the waters would make them continue to ascend for some time afterwards; and, therefore, they must be much more disposed to ascend when the attractive force is only in a small measure diminished.

The waves of the sea, which continue after a storm has ceased, and almost every other motion of a fluid, will illustrate this idea; all such effects being easily explained, from the consideration that a small impulse given to a body in motion, will make it move farther than it would otherwise have done. It is also, upon the same principle, that the heat is not the greatest upon the longest day, but some time afterwards; and that it is not so hot at twelve o'clock as at two or three in the afternoon; because there is a farther increase made to the heat already imparted. Instead of its being higher then, when the moon is upon the meridian of any place, it will always be found to happen, as far as circumstances will allow, about three hours afterwards; and the intervals between the flux and reflux, must be reckoned from that time in the same manner as before.

The sun being nearer the earth in winter than in summer, is nearer to it in February and October than in March and September; and therefore the greatest tides happen not till some time after the autumnal equinox, and return a little before the vernal.

The tide propagated by the moon in the German ocean, when she is three hours past the meridian, takes twelve hours to come from thence to London bridge: where it arrives by the time that a new tide is raised in the ocean.

These are the principal phenomena of the tides; and where no local circumstances interfere, the theory and facts will be found to agree. But it must be observed, that what has been here said, relates only to such places as lie open to large oceans. In seas and channels, which are more confined, a number of causes occur, which occasion considerable deviations from the general rule. Thus, it is high water at Plymouth about the sixth hour; at the Isle of Wight about the ninth hour; and at London bridge about the fifteenth hour, after the moon has passed the meridian. And at Batsha, in the kingdom of Tonquin, the

sea ebbs and flows but once a day; the time of high water being at the setting of the moon, and the time of low water at her rising. There are, also, great variations in the height of tides, according to the situation of coasts, or the nature of the straits which they have to pass through.—Thus, the Mediterranean and Baltic seas have very small elevations; while, at the port of Bristol, the height is sometimes near thirty feet; and at St. Malo's it is said to be still greater.

SECT. IV.—*Of Earths, Stones, Metals, Minerals, and other Fossils.*

THOSE who observe the disposition of the earth, as it appears in the quarrying or digging of mines, find it generally lying in horizontal layers, or strata of different kinds, like the settling of waters. The first layer that presents itself, is most commonly the bed of vegetable earth or mould. With this earth the surface of our globe is generally covered. It is this mould which gives rooting and nourishment to plants, so that they may stand and grow in it, and it is as it were the store-house from whence all the living creatures of our world have originally their provisions; for from thence all the plants have their sustenance, and some few animals, and from these all other animals.

As this affords to animals and vegetables their support, so the spoils of these, when dead or decayed, return to the dust of the ground, from whence they were formed, and thus keep up an unceasing circulation.

The most common disposition of the layers is, that under the first earth is found gravel or sand; clay or marl; then chalk, or coal, marbles, ores, &c. This disposition, however, is far from being uniformly continued all over the globe; in different soils the order of these layers vary.

It is wonderful the variety of productions which are found in the different parts of our globe. In the crumbling chalk, the solid marble, the dusty gravel, and even the depths of the most inland valleys, and on the summits of the highest mountains, we behold the spoils of the ocean, exhibited under the several appearances of petrified fish,

beds of shells, and sea plants. The Alps, the Appennines, the Pyrenees, Libanus, Atlas, and Ararat, every mountain of every country under heaven, where search has been made, all conspire in one uniform and universal proof, that the sea has covered their highest summits. If we examine the earth, we shall find the mouse deer, natives of America, buried in Ireland; elephants, natives of Asia and Africa, buried in the midst of England; crocodiles, natives of the Nile, in the heart of Germany; shell-fish, never known but in the American seas, together with skeletons of whales, in the most inland regions of England; trees of vast dimensions, with their roots and tops at the bottom of mines, and marls found in regions, where such trees were never known to grow, nay, where it is demonstrably impossible they could grow. Such are the awful memorials of the great convulsions and revolutions which have taken place in the natural world; of countries laid under the rolling waves of the ocean; and of lands rising from the midst of the waters, and becoming the habitations of beasts and of men; so transient and uncertain are all earthly things.

The various bodies which are found by digging in the earth, are called *fossil* substances; under which are comprehended metals, minerals, stones of divers kinds, and sundry bodies that have the texture between earth and stone.

These bodies are divided into four different classes by mineralogists, viz. I. Earth and Stones in general; II. Salts; III. Inflammables; and IV. Metals.

I. *Earth and Stones in general* are 1st, mould, the support of vegetables; 2d, clays, which mixed with water harden in the fire, into bricks, delf, china, &c. 3d, calcareous substances, as chalks, marls, limestones, marbles, convertible by heat into quicklime, and gypsum into alabaster; 4th, talcs, which are found in flat, smooth laminæ, 5th, slates also split into laminæ: these, with a variety of stones from freestone, or sand, to granite, porphyry, flint, and substances still harder, such as precious stones, are known by various properties, and are accordingly applied to different purposes; some, in addition to being serviceable in building, are used as whetstones; some strike fire with steel; others are polished to glitter in the dress of the fair, or decorate the furniture of the opulent; and others, melted by fire, form the transparent glass.

Although there seems to be an almost infinite variety of earthy substances scattered on the surface of this globe, yet, when we examine them chemically, we find that all the earth and stones which we tread under our feet, and which compose the largest rocks, as well as the numerous different specimens which adorn the cabinets of the curious, are composed of a very few simple or elementary earths, the principal of which are the *calcareous*, *siliceous*, *argillaceous*, *magnesia*, *terra ponderosa*, and a few others which have been discovered lately, but have not been much examined.

Calcareous earth is found in the shells of fishes, the bones of animals, chalk, limestone, marble, and gypsum; but all calcareous earth is supposed to be of animal origin; and beds of chalk, limestone, or marble, are thought to have been beds of shells formed in the sea, in some pristine state of the earth.

Silex, or siliceous earth, is the principal constituent part of a great number of the compound earths and stones, forming the immense mass of the solid nucleus of the globe. It is the base of almost all the scintillating stones, such as flint, rock crystal, quartz, agate, calcedon, jasper, &c. The sand of rivers, and of the sea shore, chiefly consists of it.

Argillaceous earth is found in clay, schistus, or slate, and in mica. This species of earth is ductile with water, it then hardens and contracts by heat, so as to be of the greatest use in forming brick, or stones of any required form or size.

Terra ponderosa is generally found in two states, viz. united to vitriolic acid, when it is called calk, or to fixed air, when it is called terra ponderosa aerata. This earth is distinguishable by its great specific gravity, being four times as heavy as water.

Magnesia is found sometimes pure in nature, but it is generally obtained by art from some of its combinations. It gives a peculiar character to the substances of which it forms a part. The stones which contain magnesia in considerable quantity, have generally a smooth and unctuous feel, a greenish cast, a fibrous or striated texture, and a silky lustre. Among them we may mention talc, steatite, serpentine, chlorite, asbestos, &c. Pure magnesia does not form with water an adhesive ductile mass. It is in the form of a very white spongy powder and perfectly tasteless.

Stones are formed by the mixtures of the earths together, and of the mixtures of earths with alkalis, and sometimes with acids. Stones bound together by some cement, form *rocks*. There is also a kind of stones of a peculiar nature, produced by the fire of volcanoes.

The stones in which the acids and alkalies abound, are called *saline stones*, and the mixtures of the earths with each other form stones properly so called. Of stones properly so called, those in which the siliceous earth abounds and predominates are very numerous; the principal of which we shall briefly notice.

Siliceous mixtures have sufficient hardness to strike fire with steel. Of this description are the *precious stones*, *rock crystal*, *or quartz*, *felspar*, *silex*, *crysopryse*, *lapis lazuli*, *jasper*, and *schorl*.

Gems, or precious stones, are of various kinds. They are distinguished by their hardness, weight, colour, and splendour, as well as by their property of producing single or double refractions. As their colour is, of all their characters, the most apparent, it is according to this that we shall divide them.

Red gems are the *ruby*, the *vermillion*, *garnet*, and *girasol*. The ruby is a transparent stone, the colour of which is more or less red. It is distinguished into four kinds, viz. the *oriental ruby*, the *spinel ruby*, the *balass ruby*, and the *Brazilian ruby*.

Yellow gems are the *topaz*, *hyacinth*, and *jargon of Ceylon*. Of the topaz, there are three kinds, the *oriental topaz*, the *Brazilian topaz*, and the *Saxon topaz*.

Blue gems are the *sapphire*, and the *aigue marine*.—There are two kinds of the sapphire, viz. the *oriental sapphire*, and the *Brazilian*. There are also two kinds of the aigue marine, the *oriental* and the *occidental*.

Green gems are the *emerald of Peru* and the *chrysolite*, of which there are two kinds, viz. the *Brazilian*, and that of the jewellers.

The *diamond* ought certainly to be placed among the precious stones, but it is different from all those above described. Its combustibility is a property entirely peculiar to itself; the diamond, indeed, burns in the same manner as phosphorus, disappears without leaving any vestiges of it behind. The diamond is supposed to be pure carbon, and the radical of the carbonic acid.

There are several varieties of the diamond, which differ from each other only in colour; some are of a *rose* colour, and others *red, orange, yellow, green, blue,* and *dark coloured.*

Rock crystal and *quartz* seem to be the same stone.—The name of rock crystal is given to that which is crystallized, and of quartz to that which is in a rude mass. The form of these crystals is a hexaedral prism, terminated at one of its extremities, and sometimes at both, by a summit, composed of six triangular faces. In hardness, they are inferior to all the other gems. Rock crystal consists almost entirely of pure silex. Quartz enters into the composition of granite.

Freestone is of the same nature as quartz. It is granulated, being composed of small grains of quartz, cemented together, but which have very little adhesion.

Felspar is inferior in hardness to quartz. It fuses by the action of heat, and forms white enamel. It is one of the constituent parts of porcelain.

We may mention, under this class, *adamantine spar,* which approaches near to the preceding in its appearance and fracture, but which differs from them considerably, by its great hardness, its form, and gravity. It is so exceedingly hard, that it may be employed to cut the diamond.

Flint is a stone, which is so hard as to strike fire with steel. Among the different kinds of flints, some change their colour according to the directions of the rays of light, and others do not. Of the former there are three, the *opal,* the *cat's-eye,* and the *fish-eye.*

The kinds of flints which do not change their colour according to the direction of the rays of light, exhibit tints of more or less brightness, and are susceptible of a fine polish. We are acquainted with eight kinds of them, viz. *common flint, petro silex, agate, calcedony, cornelian, sardonyx,* the *jade,* and the *prasium.*

Common flint possesses very little transparency. All the different kinds of it have a dark dull colour, and are concave or convex, on the fracture. They do not fuse in the fire, but are calcined and become white.

The distinguishing character of *petro silex* is its semi-transparency, similar to that of wax. It becomes white in the fire, like the common flint, but it is more fusible, as it runs without any addition.

Agate has a smooth shining fracture, and will take a very high polish: it is much variegated. When exposed to heat, it loses its colour, and becomes opaque, but without fusing.

The *calcedony* has a milky semi-transparency. Every kind of it takes a fine polish. These stones are white, intermixed sometimes with tints of red, yellow, and blue.

The *cornelians* are all either entirely, or in part, of a beautiful red colour, but they lose their colour in the fire, and become opaque. They are all susceptible of a fine polish.

Lapis lazuli is of a beautiful sky-blue colour, sometimes mixed with white, and is entirely opaque. It is sometimes mixed with pyrites, from which it has been supposed that it contained gold. If exposed to a strong heat, it fuses, and forms a sort of whitish glass; when calcined, it dissolves in acids into a kind of jelly. Lapis lazuli, when pulverized, forms that valuable colour known under the name of *ultra-marine*.

Jasper is a stone which exhibits every variety of colour. It is exceedingly hard, and receives a very beautiful and durable polish. When exposed to the action of heat, it does not fuse.

Schorl is a hard stone, fusible in a moderate fire, without any addition. Its crystals exhibit a great variety, in gard to form, appearance, texture, structure, &c. Schorl, in general, is opaque; some kinds, however, are transparent, such as the *Brazilian emerald*, the *peridot*, the *tourmalin*, &c.

The colour of schorl is various; some kinds are black, others violet, and some green. Schorl enters into the composition of porphyry, serpentine, the opite, granitell, and granite.

The primitive earths form stones, as we have mentioned, and stones united by cement, form those masses called rocks. We shall notice the six mixtures which are most commonly found in those masses, viz. *porphyry*, *serpentine*, *ophites*, *granitell*, *granite*, and *flint*.

Porphyry is composed of felspar in small fragments, of schorl, and a kind of cement, which unites all the parts, and which, in some measure, forms the base. Porphyry

is exceedingly hard, and difficult to be cut; it will, however, take a fine polish. Some kinds of it are red, and others green.

Serpentine is composed of the same substance as prophyry. The only difference is, that the felspar is in larger fragments. The colour of serpentine is various; some kinds are green, others violet, some yellow, and some black.

The *ophite* is composed of only two substances, viz. black schorl, known under the name of ancient black basaltes, interspersed with greenish felspar, which forms in it long spots. This stone has considerable hardness.

Granitell is also composed of two substances; black schorl, and white felspar, mixed with some of the green felspar. The only difference, then, between the granitells and the ophites is, that the schorl which enters into the composition of the former, is not of the same kind as that in the latter.

Granite is composed of felspar, schorl, and quartz. The colour of granite is various; it is hard, difficult to be worked, and receives a fine polish.

Flint is a hard opaque stone, susceptible of a very beautiful polish. It appears to be composed of concentric strata, and has considerable brilliancy on its fracture.—Flints are never found in continued quarries, like the other stones; they are found detached, and dispersed throughout the fields. When joined by any kind of cement, they form *pudding-stones*. They become decomposed in the air, for they are found for the most part covered with a crust, of a softer nature than the anterior part. Their colour is exceeding various; some of them are spotted and variegated with veins, others exhibit the resemblance of plumes and even of plants.

Volcanic productions are chiefly *pumice-stones, lava,* and *basaltes.*

Pumice-stone is real glass, in the form of small greyish, white, and exceedingly brilliant filaments. These filaments always have vacuities of greater or less size between them, which occasions great variations in its specific gravity. In general it is lighter than water.

Lava is that burning matter which runs down in such prodigious quantities, from volcanos, when in a state of

eruption, and often extends to a great distance. This matter is a semi-vitrified substance, which appears blackish, on account of its density.

Basaltes is blackish and opaque. By the action of heat it may be converted into glass, of a very beautiful black colour. It often crystallizes in prisms, of three, four, five, six, or seven planes. Of some kinds, such as that known under the name of *touchstone*, the grain is exceedingly fine.

II. *Of Salts.*—The alkalis, the acids, and the combinations in which they enter in sufficient quantities, are called *salts*, or *saline substances*; for a saline substance, in its extended chemical sense, means a substance that has some taste, and is soluble in water. These substances, however, do not strictly and exclusively belong to the fossil department, but are obtained also from animal and vegetable substances. They are the most active agents in creation. They give bodies their consistency; preserve them from corruption, and render them savoury.

Alkalis are distinguishable by their acrid, burning, and urinous taste, their causticity, their singular action on the skin, and all animal substances, the quality of changing the blue colour of violets to a green, and even a greenish yellow, and deliquescency. We are acquainted with three species, *potash*, *soda*, and *ammonia*. The first and second have been called *fixed alkalis*, because they melt and grow red in the fire before they become volatile; the third has been named *volatile alkali*, from possessing the opposite property.

Potash is known by the following characters:—It is dry, solid, white, and very deliquescent, absorbs water with heat, and a peculiar faint smell, combines with siliceous earth by fusion, and forms glass. It is frequently found native with lime, and combined with different acids; but is chiefly obtained from vegetables, in the ashes of which it remains after combustion.

Soda, or the *mineral alkali*, is procured from the ashes of sea-weed, and constitutes the basis of sea salt. It strikingly resembles potass in form, causticity, fusibility, deli-

quescency, combination with earthy substances, by means of fusion, action on animal substances, &c. so that it was long confounded with it, and might have continued to be so, if it did not form very different salts with acids, and yields these acids to potash.

Ammonia, or *volatile alkali*, differs greatly from the two preceding species in its form of gas when dissolved in caloric, in its liquid form when dissolved in water, in its pungent and suffocating smell, its solubility in air, &c.—Ammonia is procured by burning animal substances; in Egypt, (from whence, as contained in *sal ammoniac*, we till of late imported it) from camel's dung; but now from bones by distillation.

All *acids* appear to be combinations of oxygen or vital air, with elementary substances. Their taste is sour, as their name imports. They change most of the blue vegetable colours red, and have a tendency to combine with earths, alkalis, and metallic substances.

All acids, being compounds of oxygen with different substances, the former principle is the cause of their resemblance and common properties; the latter, being different in each, may serve to characterise each in particular. For this reason, those matters which are variable in acids, are termed their *radicals*, *acidifiable* principles. Thus all acids are combinations of radicals, or acidifiable substances, different in each species, with oxygen, which is the same in all: whence it follows, that their common properties, their characters as acids, depend on oxygen, which is the acidifying principle: their particular properties, their specific characters, arise from their radicals. The word *acid*, indicating the general and identical nature of these substances, forms their generical name, where the particular name of the radical contained in each, may, with propriety, designate each particular acid. Thus sulphur is the radical of the acid we name *sulphuric*; phosphorus that of the *phosphoric*; carbon that of the *carbonic*, and so on.

Acidifiable radicals may contain different quantities of oxygen, and under this point of view they possess two states of acidity. The first is that, in which they contain the least possible quantity of oxygen to render them acid. In this their acidity is commonly weak, and they adhere

but feebly to the bases with which they are capable of forming salts. The modern methodical nomenclature designates this state of combination and acidity, by giving the names of these weak acids the termination of *ous*.—Thus we say the sulphurous, nitrous, phosphorous, or acetous acid. The second state of acids is that, in which they contain more oxygen, and in general are completely saturated with it. In this they have all the strength and attraction they are capable of possessing as acids, and the modern nomenclature expresses it by the termination *ic*. Thus we say the sulphuric, nitric, phosphoric, or acetic, acid. With regard to the proportion of oxygen united to acidifiable radicals, still greater latitude may be given to the consideration presented above. Each radical may be contemplated in four states:—1st, Containing very little oxygen, not sufficient to impart to it the nature of an acid, and in this it is nothing more than an oxyd; such as sulphur coloured red or brown, by exposure to the air, and a degree of heat inadequate to produce inflammation; when it is oxyd of sulphur.—2dly, Containing more oxygen than in the preceding case, and enough to become an acid, though weak; as in the sulphurous acid.—3dly, Possessing still more oxygen than in the second instance, and having acquired powerful acid properties, such as the sulphuric acid.—4thly, Conjoined with a larger doze of oxygen than is necessary to constitute a powerful acid, an acid in *ic*; when it is termed an oxygenated acid, or even super-oxygenated.

The acids are generally divided into *mineral*, *vegetable*, and *animal* acids, according to the nature of their radicals. Though the first class only with propriety claims notice in this place, yet for the information of the reader, we will enumerate those belonging to each of the above classes.

The *mineral acids* at present known, are the sulphuric (formerly called the *vitriolic*) acid; the nitric acid, called also *aquafortis*; the muriatic or marine acid, called by artizans the spirit of salt; the carbonic acid, formerly called the acid of *charcoal*, *aerial acid*, or *fixed air*, &c. the phosphoric acid, which is likewise an animal acid, it being found amongst animal matters as well as among minerals; the acid of borax; the fluoric acid, formerly called the *acid of spar*; the arsenic acid; the molybdic acid;

the tungstenic acid; and the chromic acid. The last four are also called *metallic* acids.

The *vegetable acids* are the acetic or vinegar, the acid of tartar, the empyreumatic acid of tartar, the oxalic or acid of sorrel, the acid of galls, the citric or lemon acid, the malic or acid of apples, the benzoic or the acid of benjamin, the empyreumatic acid of wood, the empyreumatic acid of sugar, the acid of camphor, and the suberic or acid of cork.

The *animal acids* are, the acid of milk, the acid of sugar of milk, the formic or acid of ants, the prussic acid, viz. the colouring matter of Prussian blue, which is obtained from dried blood, hoofs, &c. the sebacic or acid of fat, the bombic or acid of silk-worms, the laccic or the acid of waxy matter, and the zoonic or the acid extracted from animal matter by means of lime.

For a more full account of these acids, we refer the reader to various recent publications, written professedly on the subject of chemistry.

Acids and alkalis shew strong attractions for each other, and when combined together in such proportion that neither of them predominates, form *neutral salts*. substances altogether dissimilar to the elements of which they are composed. The salt in common use, for instance, is formed of mineral acid and alkali; either of which, singly, would be hurtful to the human body; and the acid, in particular, would be extremely pernicious.

Each acid produces with each of the three alkalis a particular neutral salt. The number of the last may therefore be found by multiplying the number of the acids which we know, by *three*, the number of the alkalis.

III. *Inflammables.*—Inflammables are sulphur or bitumens. These substances are both derived from the spoils of vegetables and animals.

Sulphur, known also by the name of *brimstone*, is a simple combustible substance, which nature frequently presents in a pure state. It is found in the earth in a loose powder, or solid; and either detached, or in veins. It is met with in the greatest plenty in the neighbourhood of volcano's, and is deposited as a crust on stones conti-

guous to them. It is also met with in mineral waters, coal-mines, &c. and also in combinations with most of the metals.

The bitumens are *naptha*, *petrol*, *mineral tar*, *asphaltum*, *jet*, *cannel-coal*, *mineral tallow*, *pit-coal*, *amber*, &c.

Naptha is a white or yellowish-white substance, fluid as water, feels greasy, has a penetrating smell, and burns with a light flame, leaving scarcely any residuum.

Petrol, or *petroleum*, is a brown semi-transparent substance; being naptha, thickened, and altered in colour and other respects by the air.

Mineral tar is petrol farther altered by the air, having become of the colour and consistency of pitch.

Asphaltum, or *mineral pitch*, is produced by a still farther exsiccation or drying.

Jet is a substance of a full black, harder and less brittle than asphalt; and, according to *Wiedenman*, is a species of coal.

Cannel-coal appears to be next to jet, in gradation, of the compound mineral bituminous substances.

Mineral tallow is rarely met with, and imperfectly known. It much resembles tallow.

Mineral caoutchoc is a substance much resembling, in its elastic properties, the substance from which it takes its name.

Pit-coal, according to *Mons. Gensanne* and others, is an earth or stone, chiefly of the argillaceous genus, penetrated or impregnated with petrol or asphalt. It has also been supposed to have been formed by vegetables growing in the sea, and by vast forests which have been buried by subsequent revolutions.

Amber is a bitumen generally of a yellow or brown colour. It is found either under the surface of the ground, among the clay, sand, and iron bog ore, when it is called *fossil amber*; or is thrown on the shore by the waters of the sea, and is then called *mineral amber*. It is tasteless, but when rubbed, it yields a faint odour, and manifests electric powers.

IV. *Metals.*—We are at present acquainted with *twenty-one* metallic substances, essentially different from each other; *gold*, *platina*, *silver*, *mercury*, *lead*, *copper*, *iron*, *tin*, *zinc*, *bismuth*, *antimony*, *arsenic*, *cobalt*, *nickel*, *man-*

ganese, *molybdena*, *wolfram*, *chrome*, *uranium*, *titanium*, and *tellurium*.

Metals exceed all other fossils in specific gravity*; but there exists, in this respect, a remarkable difference among themselves. They are completely opaque. They also possess a mirror-like lustre, which is one of their characteristic marks; and they present a convex surface when melted in earthen vessels. Besides, they are all indissoluble in water. And by these *external characters*, it is easy to distinguish this class from all other *fossils*, viz. earths, salts, bitumens, and sulphur.

Metals are concealed in the earth, and form *ores*, which, existing in crevices of rocks, are called *veins*, and are distinguished into *level*, or into *inclined*, *direct*, or *oblique*, according to the angle they make with the horizon. The part of the rock resting on the vein, is termed the *roof*; and that on which the vein rests, the *bed of the vein*. And the cavities made in the earth, in order to extract these ores, are called *mines*.

When nature has bestowed on metals their proper metallic appearance, or they are only alloyed with other metals, they are said to be *native*. When combined, as they commonly are in mines, with some unmetallic substance, they are said to be *mineralized*: the substance that sets them in that state is called a *mineralizer*, and the compound of both, an *ore*; which term is applicable when stones, or earths, contain metallic substances, whether native or mineralized, in a notable proportion.

Several metals are *ductile* and *malleable*, and their parts may be displaced from each other by compression, or hammering, without losing their cohesion. Hence, some of them may be stretched out to thin laminæ, or drawn into slender filaments; as, for instance, gold, silver, platina, copper, lead, tin, and iron.—Other metals are *fra-*

* The specific gravity of any body is the proportion which its weight bears to the weight of another body of equal bulk. The established custom is to compare all bodies with water, the specific gravity of which is reckoned one, or unity; so that when the specific gravity of any body, as gold, for instance, is said to be 19, zinc 7, we mean that equal quantities of water, gold, and zinc, weigh respectively 1, 19, and 7, be they pounds, ounces, grains, or any other weights.

gile, or brittle, and do not admit of being stretched and extended; such are antimony, arsenic, cobalt, bismuth, &c.

All metals are fusible, but not all in the same degree; thus mercury is melted even by the usual temperature of our atmosphere. Some metals, as tin and lead, melt even *before* ignition; others, as silver, gold, copper, iron, fuse only *after* being ignited.

All metals, iron and platina only excepted, melt, on a sudden, as soon as they are heated in a due degree; but iron and platina grow soft before they fuse, and on this depends their very useful property of becoming capable of being *welded*.

Almost all metals may be combined by fusion into one seemingly homogeneous mass; and from thence various *metallic mixtures, metallic alloys*, or compositions, arise; which, for their particular properties, are often of very great utility.

If metals be continued in fusion, they lose their brilliancy, and become an opaque powder, or what is termed a metallic *oxyd* or *calx*.

All metals, gold, silver, and platina excepted, are *oxyded* or calcined in fire with access of air. In this respect, those which cannot be oxyded *by fire* have received the name of *noble metals*, to distinguish them from the rest, which may be calcined that way, and are called *base metals*.

Gold is a noble metal, of a yellow colour; and, after platina, the heaviest of metals. Its specific gravity is from 19.258 to 19.640. Its hardness and elasticity are inconsiderable; but its tenacity is great; and with regard to ductility, or malleability, it exceeds all other metallic substances.

Platina is a noble metal, of a white colour; for which reason some call it *white gold*. In Europe it is known only since the middle of the present century, and brought to us in small irregularly-figured grains, but which are impure, and mostly contaminated with iron. Pure platina exceeds all other metals, even gold, in specific gravity; it is often found to reach 21.061. It is ductile and malleable; its hardness and tenacity are greater than those of gold, and it admits of being welded.

Silver is a noble metal, of a white colour, whose specific gravity is variable from 10.474 to 10.542; it is very

malleable and ductile, and of a moderate hardness. It fuses in a heat of less intensity than is required by gold; it is fixed in fire, and is not affected by water nor air, remaining in both unaltered; but by sulphureous vapours it is very soon tarnished.

Mercury, or *quicksilver*, is a base metal, of a white colour. Its specific gravity is upon an average 13.074. It is the most fusible of all known metals, and continues in the fluid state even in the cold temperature of our winters; it congeals only at 40 Farenheit, and shews then some tenacity and ductility.

Lead is a base metal, of a bluish-white colour. Its specific gravity is from 11.352 to 11.445. It is considerably ductile, but little tenacious and hard; hence it may be extended in thin plates by the hammer, but not drawn into fine wire. It has scarcely any elasticity.

Bismuth is a yellowish or reddish-white metal, of a foliated fracture, and very brittle, it being even reducible to powder by the hammer. Its specific gravity is from 9.670 to 9.822. It is somewhat harder than lead, but more fusible.

Nickel is a greyish-white metal, of a specific gravity between 9.000 and 9.333. It is malleable, and very compact or firm.

Copper is a base metal, of a brownish red colour; sonorous, very tenacious, ductile, and malleable; of a considerable compactness, of a moderate hardness and elasticity, and of an hackly fracture. Its specific gravity varies from 7.788 to 9.000.

Arsenic is a brittle metal, and, on the recent fracture, of a mean colour betwixt tin white and lead grey, but, on exposure to air, it soon turns black and dull. Its specific gravity is 8.310; its hardness is somewhat considerable, and seemingly surpassing that of copper; but its ductility is so little, and its brittleness so great, that it is readily converted into powder by the hammer.

Of all metals *Iron* exhibits the most varieties and deviations. Its differences in colour, density, fracture, tenacity, ductility, and degree of fusibility, are uncommonly great. Soft and malleable iron has a greyish white colour—a light grey, fibrous, hackly fracture. Its specific gravity, at a mean rate, is 7.700; its hardness is not great, but its malleability and tenacity are considerably

so; and it has this characteristic property, not possessed by other species of this metal, that, whether cold or ignited, it may be extended, forged, and bent, without breaking.

By *cast* or *crude iron*, that metal is understood, which is obtained by the first smelting of iron-ores. Such iron is distinguished from ductile iron by its refusing to be extended and forged by the hammer, whether cold or ignited, by its brittleness, and by its fusing in strong heat in open fire, without addition, whereby it is rendered capable of being cast into moulds. The colour of crude iron is more or less of a pale grey.

Steel differs both from the ductile and the crude iron. Its distinguishing property is, that when it is *tempered*, that is to say, when it is hastily plunged in cold water while ignited to redness, it becomes harder, more brittle, and inflexible; and that, before this tempering or hardening, it is ductile, whether cold or ignited; and also, that, after having been hardened, it reassumes its ductility by a fresh ignition and gradual cooling, without quenching. Its colour is a light grey, its fracture finely granular.

Cobalt is a base metal, of a lead-grey colour, brittle and hard, and of a specific gravity from 7.000 to 7.700. This metal is rather of difficult fusion.

Tin is a base metal, of a white colour, a little more verging to blue than that of silver. It is very soft, pretty malleable and tractable; its compactness and elasticity are but slight. When broken or bent, or when compressed between the teeth, it makes a peculiar crackling noise, which is one of its characteristic properties. The specific gravity of tin is variable from 7.216 to 7.731. Its gravity decreases in the ratio of its purity.

Zinc is a white metal, of a radiated texture, changing into the foliated. It is of a middle kind between the malleable and brittle metals, and may be extended into thin laminæ, at least between metallic cylinders in rolling mills. The specific gravity of this metal is from 6.862 to 7.215.

Antimony has a white colour, resembling that of tin, a foliated radiated texture, and is very brittle. Its specific gravity varies from 6.702 to 6.860. In the air it loses little of its metallic splendour, and it does not rust in the strict sense of the word.

Manganese is a white, hard, brittle metal, whose specific gravity is found to be from 6.853 to 7.000.

Molybdena has a pale lead-grey colour, a metallic lustre, and a lamellated fracture; it is very soft, and marks paper easily, leaving a shining trace. Its specific gravity is between 4.138 and 4.569.

Wolfram is a metallic substance, of modern discovery, and of a particular kind, whose calx or oxyd is of a yellow colour, and one of the constituent parts of the fossil, called *tungsten*.

Another distinct metallic substance, only a few years since discovered by Klaproth is the *Uranium*. The oxyd of uranium has a lemon-yellow colour, is fixed in fire, and infusible when alone. Ignition changes its colour to a brownish-grey.

We are likewise indebted to Klaproth for the discovery of the new metal called by him *Titanium*, or *Titanite*. It is contained in the mineral called red shoerl as a native oxyd. The colour of the perfect oxyd of titanium is red; but when kept in violent ignition upon coals, and by a greater degree of disoxydation, it gradually assumes a yellowish, bluish, and blackish hue.

Tellurium is a metal of a white colour, like tin, inclining to lead-grey. It is brittle and friable; possesses a lamellar texture, and considerable metallic lustre; is one of the most easily fusible metals, and exhibits a crystallized surface when slowly cooling after fusion. Its specific gravity is 6.115.

Chrome is a white metal, inclining to grey, very brittle, and crystallizable at an elevated temperature in feathered filaments on the surface.

The minerals to be found in England are both curious and useful. Amber, jet, vitriol, and alum are found in considerable quantities; our cannel-coal approaches nearly to the beauty of jet, and even our common coal for firing is of a superior nature. The English earth and gravel are of the best quality; and we have stones, slates, flags, and other fossils necessary for building, in great abundance. Tin is another article in which England, from the time of the Phenicians, has always had the pre-eminence. The county of Cornwall alone produces more than all the world besides. Our lead-ore is richer than in other countries, runs more fluently in the fire, re-

quires less trouble and expence in working, and is, when wrought, very fine and ductile. Our black lead, or wadd, found in Cumberland, is a mineral of great use and value in several branches of trade and arts. Copper and iron are also found here in great plenty; and several ores of these metals, particularly in Anglesey, have of late been discovered, and brought into use, which were unknown before the recent improvements in chemistry.

SECT. V.—*Of Vegetables, or Plants.*

NEXT to the earth itself, we may consider those that are maintained on its surface; which though they are fastened to it, yet are very distinct from it: and those are the whole tribe of vegetables, or plants. These may be divided into three sorts, *herbs, shrubs,* and *trees.*

Herbs are those plants, whose stalks are soft, and have nothing woody in them, as grass, sowthistle, and hemlock. *Shrubs* and *trees* have all wood in them; but with this difference, that shrubs grow not to the height of trees, and usually spread into branches near the surface of the earth; whereas trees generally shoot up in one great stem or body, and then, at a good distance from the earth, spread into branches; thus, gooseberries and currants are shrubs, oaks and cherries are trees.

Numerous are the works which have been written, especially in later times, on the science of botany, and various systems or classifications of plants have from time to time been proposed; but the sexual system of Linnæus is at present generally received. This naturalist has drawn a continued analogy between the vegetable economy and that of the animal; and has derived all his classes, orders, and genera, from the number, situation, and proportion of the parts of fructification. In twenty-four classes, he has comprehended every known genus and species. In considering a plant with a view to its characteristics, or distinguishing features, it is divided by Linnæus into the following parts, making so many outlines, to which the attention of the botanical observer must be be directed: 1. Root; 2. Trunk; 3. Leaves; 4. Props; 5. Fructification; 6. Inflorescence. 1. The *root* consists of two parts, the *caudex* and the *radicula.* The *caudex,*

or stump, is the body or knob of the root, from which the trunk and branches ascend, and the fibrous roots descend; and is either solid, bulbous, or tuberous; solid, as in trees and other examples; bulbous, as in tulips, &c.; tuberous, as in potatoes, &c. The *radicula* is the fibrous part of the root, branching from the *caudex*. 2. The *trunk*, which includes the branches, is that part which rises immediately from the *caudex*, in either herbaceous, shrubby, or arborescent; and admits of several other distinctions, according to its shape, substance, surface, &c. 3. The *leaves* are either *simple*, as those that adhere to the branch singly; or *compound*, as when several expand from one footstalk. Leaves are farther described by various terms, indicative of their form and outline. 4. The *props*, those external parts which strengthen, support, or defend the plants on which they are found, or serve to facilitate some necessary secretion; as, the *petiolus*, or footstalk of the leaf; the *pedunculus*, or footstalk of the flower; the *stipula*, or husk, that is, the small leaves that generally surround the stalk at its divisions; the *cirrhus*, or tendril; the *pubes*, or down; the *arma*, or defensive weapon, as thorns. 5. The *fructification*, or *mode* of fruit-bearing. 6. The *inflorescence*, or *mode* by which the flowers are joined to the several peduncles.

In plants there is an infinite diversity; some require a long succession of ages to bring them to perfection, while others attain their full maturity in a few hours; some are of immense magnitude, while others are of an inferior stature, descending by gradation till they become too minute to be cognizable by the senses. The mighty baobob of Senegal, described by Adanson, whose stem is 75 feet in circumference, stands a stately monument on the face of the earth for many thousands of years; while the mushroom, which it much resembles in form, springs up in a day, perfects its seeds, and is withered to morrow; and when we carry our views still farther, into that immense profound of minuteness which has but of late been partly laid open to us by the invention of the microscope—into the class of mosses, which are in some measure cognizable by the naked eye—and still farther, into the more minute class of plants denominated *mould*, which, even in those of the largest species, are too small to have their parts cognizable by the naked eye, and which, when viewed by

the best microscopes, discover a series of existences diminishing by a regular gradation, like stars in the galaxy under the best telescopes, till they are lost in the infinity of minuteness, leaving every reason to believe, that, could the magnifying powers of our instruments be augmented a thousand fold, we should still find ourselves as far from discovering the termination of this series of infinite diminution as we were at the commencement of our imperfect survey. The world that we see, therefore, seems to be but a very small part of that which exists; our feeble optics are capable of taking in scarcely a point of that universe which surrounds us; and our imperfect understandings can scarcely obtain a glimpse of that infinite power and wisdom which regulates the whole. Among this infinity of objects, however, we can clearly perceive the most perfect regularity and order pervading every part; and that all the operations of nature proceed with invariable steadiness to effect the purposes for which they have been designed.

Thus we see that all animate objects, from the largest that has been discovered on this globe, to the smallest that can ever be made to be perceptible to us, invariably proceed from other animated objects of the same kind, although they appear at times under such disguised forms as not to be at first sight cognizable by us. This rule applies to vegetables as well as animals. The plant of *mould*, which, even when it hath attained its full stature, can scarcely be perceived as a point under our microscopes of the highest magnifying power, we have every reason to be satisfied, produces its seeds in as regular order, which ripen at their appointed period, with the same regularity as those of the mighty baobob; but while this remains a stately monument upon the surface of this earth, and sees thousands of generations of men succeed each other, and successively shelter themselves under the protecting shade of its spreading branches, we observe the *mould* spring up, perfect its seeds, scatter them in imperceptible myriads in the air, and disappear within the short space of *one hour:* so that during the short period of our existence here many myriads of generations of mould have succeeded each other. *Time* itself then, when the universe is viewed as a whole, can only be considered as a relative object. Shall man then, a being

who cannot comprehend fully the nature of a single object around him, dare proudly to lift up his face, and pretend to decide concerning possibilities and the powers of nature! His proper province is to be humble, and adore!

The plants with which we are best acquainted, may be arranged into three grand divisions. The *first* are those whose roots and stems remain for many years, which comprehends all the varieties of trees and shrubs. These, for the most part, require several years to bring them to a state of puberty (if that phrase may be admitted), when they begin to put forth flowers, and perfect their seeds; after which time they usually continue to produce an annual crop of flowers and seeds for a long period of time; the fruit in general succeeding the flowers, and perfecting their seeds in the same year; but to this rule there are several exceptions. In a few instances the seeds do not attain to maturity in the same season that the flower is produced; but, continuing upon the tree the whole winter in an immature state without being killed, they advance in the second season, and then only perfect their seeds; instances of which are to be found in the juniper and orange tree. Others continue to advance for several years, as usual, without showing fruits; and when at length they reach that state of maturity, they then flower, and, having perfected their seeds, they decay, and flower no more, dying away like annual plants; an example of which is to be found in the cabbage tree of tropical regions. Some are scarcely ever (perhaps never) known to produce either flowers or seeds of any sort, but admit of being propagated by some other means; instances of which are to be found in the English elm of our own country, the jack or bread fruit tree of India, and many others.

The *second* division of plants are those that have a perennial root, from which stalks are sent forth annually, which usually produce flowers, perfect their seeds in the summer, and die down to the ground at the approach of winter. The stems of these are for the most part of a similar structure and consistence with those of

The *third* class, or annuals, from the seeds of which, if sown in the spring, stalks spring up, which produce flowers and seeds the same season; after the perfecting

of which the stalks decay and die entirely away. Biennials can only be viewed as a diversity of these that have not sufficient length of season to bring them to perfection in one year.

Whether distinctions similar to these take place among those minute tribes of plants which we call microscopical, it exceeds our power at present to determine. From the short period of their existence, we have been generally inclined to think that they are all similar in quality to annuals; that is to say, that they flower but once, and die down immediately after they have once perfected their seeds. Yet, who dares to pretend to say, that the plant of *mould*, which exists perhaps but one of our hours, may not produce in that period many thousands of successions of ripe seeds, each of which has taken its due season to ripen like those of the baobob, which flourishes on our globe for hundreds of ages! for the same infinite power which has decreed that the total duration of this plant shall be limited to an hour, may have also decreed, that the maturation of its seeds, and the completion of a period that to *it* should be similar to that of our year, should be accomplished in the thousandth part of a second of our time.

All plants seem to grow in the same manner: the genial warmth of the sun, the refreshment of the rains, the same soils appear to suit their respective species; and, upon a superficial glance, they seem to have the same common parts. A chymical analysis discovers the same constituent principles in all, that is to say, calcareous earth, oil, water, and air, with a portion of iron, to which they owe their beautiful colours. Yet, although composed of similar materials, their juices to the eye, and to the taste, appear as various as their forms. The soporific milk of the poppy, the acrid but equally milky juice of the spunge, the acid of the sorrel, the saccharine sap of the sycamore and maple, and the resin of the tribe of pines, bear no resemblance to each other.

The inward structure of plants is as regular and various as their external forms are elegant and well proportioned. The root, trunk, branch, leaf, flower, fruit, and seed, have each its peculiar character and form. No part in the contexture of the smallest fibre is unfinished, but is formed with the most minute exactness. The seeds of plants have the appearance of shells, unlike in form, and diversified

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with spots and stripes. Every seed possesses a reservoir of nutriment, designed for the growth of the future plant. This is the matter prepared by nature for the reproduction and continuation of the whole species. This nutriment consists of starch, mucilage, or oil, within the coat of the seed, or of sugar and subacid pulp in the fruit, which belongs to it. The sections of the various kinds of trees are crossed with the greatest number of regular figures which the imagination can conceive. The lines, which form the texture of fir trees, are distant; but those of oak are close and compact. And this difference of texture may serve to account for their greater or less solidity, and the difference of time requisite for them to arrive at maturity.

The nourishment of plants is performed chiefly by the tender fibres of the roots, which being spread under ground, imbibe from the moist earth juice fit for their nutriment, which they transmit to the other parts. The impulse by which the juices rise seems to be capillary attraction; for the roots of all vegetables are supposed to be but bundles of capillary tubes: and whether we consider earth, water, salt, and oil, as the food of plants—or, with Kirwan, that coal is essential to that food—or with Ingenhous, that it is vital air decomposed into fixed air and azote: still that food must be formed by water into an emulsion, capable of being acted upon by capillary attraction; and as all roots are but assemblages of these tubes, there can be little doubt but their attraction supplies the plant with its first food; though other causes must assist in carrying it to the tops of the tallest trees, such as dilatation and contraction, by the successive heat and cold of day and night, the muscular action of vascular rings round the tubes irritated to contraction by the stimulent sap, &c. The interior bark conducts the nourishment supplied by the earth.

After the sap has thus ascended to the leaves, it there undergoes certain alterations, and is converted into another fluid, called the *succus proprius* or *peculiar juice*; which, like the blood in animals, is afterwards employed in forming the various substances found in plants. The leaves may therefore be considered as the digesting organs of plants, and as equivalent in some measure to the stomach and lungs of animals. The leaves consequently are not mere ornaments; they are the most important parts

of the plant. Accordingly we find, that whenever we strip a plant of its leaves, we strip it entirely of its vegetating powers till new leaves are formed; for when the leaves of plants are destroyed by insects, they vegetate no longer, and their fruit never makes any further progress in ripening, but decays and dries up.

Leaves on one side draw nutriment from the air, and perspire on the other; for plants, as well as animals, perspire, and, in both cases, this function is essential to health. The quantity they perspire varies, according to the extent of the surface from which it is emitted, the temperature of the air, the time of the day, and the humidity of the atmosphere. Leaves are the greatest part of the surface, and it is found that the quantity of these very materially affect the quantity of perspiration; and this process is increased or diminished, chiefly, in proportion to the increase or diminution of the foilage of vegetables. The degree of heat in which the plant is kept, also varies the quantity of matter perspired; this being greater, in proportion to the greater heat of the surrounding atmosphere. The degree of light has likewise considerable influence in this respect; for plants uniformly perspire most in the forenoon, though the temperature of the air, in which they are placed, should be unvaried. A plant also exposed to the rays of the sun; has its perspiration increased to a much greater degree than if it had been exposed to the same heat under the shade. Finally, the perspiration of vegetables is increased in proportion as the atmosphere is dry, or, in other words, diminished in proportion as the atmosphere is humid. The more vigorous and healthy the plant, the more copious the perspiration; this function, like the rest, depending much on the vital energy. Excessive perspiration seems to hurt, and even sometimes to destroy, vegetables; defective perspiration is equally injurious. It is also found, that this function is performed, chiefly, if not altogether, by the leaves and young shoots. That it may be properly carried on, all leaves are deciduous; in those trees called ever-greens, there being a constant succession of leaves, to prevent the organ of perspiration from becoming rigid.

A quantity of moisture is absorbed by plants, when exposed to a humid atmosphere. This absorption, as well as the perspiration, is performed by the leaves; but in

what manner has not yet been ascertained. Experiments made by M. Guettard shew, that perspiration is more considerable from the upper, than from the under, surface of the leaves.

Plants in general are known to receive and transpire more, in equal time, than large animals. It has been found by accurate calculation, and repeated experiments, that a plant of the sun flower receives and perspires, in twenty four hours, seventeen times more than a man.

Some botanists have conceived, that plants, as well as animals, have a regular circulation of their fluids.—Others think this very improbable. On both sides, recourse has been had to experiments, and from these conclusions perfectly opposite have been deduced; so that no certain conclusion can be drawn on this head.

Light has great effect on vegetation. Plants that grow in the shade, or in darkness, are pale, and without colour; and the more they are exposed to the light, the more colour they acquire.

Vegetables are not only indebted to light for their colour; their taste and odour are derived from the same source. Hence it happens that hot climates are the native countries of perfumes, odoriferous fruits, and aromatic resins.

The action of light on the organs of plants, causes them to pour out streams of pure air from the surfaces of their leaves, while exposed to the sun: whereas, on the contrary, when in the shade, and at night, they emit air of a noxious quality.

The various secretions of vegetables, as of odour, fruit, gum, resin, wax, honey, &c. seem brought about in the same manner as in the glands of animals; the tasteless moisture of the earth is converted by the hop plant into a bitter juice; as by the caterpillar in the nutshell, the sweet kernel is converted into a bitter powder. While the power of absorption in the roots and barks of vegetables is excited into action by the fluids applied to their mouths like the lacteals and lymphatics of animals.

The individuals of the vegetable world may be considered as inferior or less perfect animals; a tree is a congeries of many living buds, and in this respect resembles the branches of coralline, which are a congeries of a multitude

of animals. Each of these buds of a tree has its proper leaves or petals of lungs, produces its viviparous or its oviparous offspring in buds or seeds; has its own roots, which extending down the stem of the tree are interwoven with the roots of the other buds, and form the bark, which is the only living part of the stem, is annually renewed, and is superinduced upon the former bark, which then dies, and with its stagnated juices gradually hardening into wood, forms the concentric circles, which we see in blocks of timber, which annual rings serve as natural marks to distinguish the age of trees.

The botanist follows nature into her most retired abodes, and views her in her simple state, and native majesty. He remarks some of her productions disfigured by cultivation in gardens, where, amid all the varieties of the apple and the pear, however distinguished by their colour, size, and taste, he observes, that there is but one original species of each, and that they have respectively but one radical character. He beholds the wonderful prodigality of nature, even in the composition of the common daisy, which consists of more than two hundred flowers, each including its respective corolla, germ, pistil, stamina, and seed, as perfectly formed as those of a complete lilly or hyacinth.—And he sees this diversity as fully illustrated in the different sorts of grass, a term which, although it commonly conveys only one notion to the vulgar mind, and one object to the undiscerning eye, consists of five hundred different species, each formed with infinite beauty and variety. From others he particularly distinguishes the elegant *briza media*, so common in the fields, and so remarkable for its delicate hair-like stem, trembling at every breeze; the *anthoxanthum odoratum*, which gives its fragrance to the new-mown hay; and the *stipa pennata* with its waving plumes resembling the feathers of the bird of paradise. The botanist enjoys a pleasing, an innocent amusement, most agreeably combined with a love of rural retirement, and which gives a new and growing interest to every walk and ride, in the most delightful season of the year. Indeed man cannot contemplate the vegetable creation without recalling the idea of beauty, sweetness, and a thousand charms that captivate the senses. The perfume of the rose, and the stately magnificence of the forest, successively catch his attention and delight him.

The number of species of plants already known is about twenty-five thousand: and botanists suppose that double that number, at least, remain to be discovered.

The different vegetable productions are no less useful than numerous. The purposes to which the trees of Britain are applied, are well known, from the flexible willow, which forms the basket, to the hardy oak, which composes the most substantial parts of a ship of war, guards the British islands from foreign invasion, and displays to the most remote countries the greatness of our maritime power. All possess different qualities, adapted to their different purposes. The meanest, and in their appearance the most unpleasant, have their use; even the thistle is not only the food of some animals, but is serviceable in making glass. There is scarcely a plant, which although rejected as food by some animals, is not eagerly sought by others. The horse yields the common water hemlock to the goat, and the cow th long-leafed water hemlock to the sheep. The goat again leaves the aconite, or bareberries to the horse. The uphorbia, or spurge, so noxious to man, is greedily devoured by some of the insect tribes. The aloe is a magazine of provisions and of implements to the Indians who inhabit the banks of the Ohia and the Mississippi. Some plants, as rhubarb and opium, alleviate the tortures of pain; and some, as the quinquina, or Peruvian bark, can subdue the rage of a burning fever. Wheat, the delicious and prolific grain, which gives to the inhabitants of the northern world their wholesome nutriment, grows in almost every climate. Where excessive heat, or other causes, prevent it from coming to perfection, its place is amply supplied by the breadfruit, the cassavi root, and maize, and more particularly by rice, which is the common aliment of that great portion of mankind who inhabit the warm regions of the earth.—Every meadow in the vernal season brings forth various kinds of grass; and this spontaneous and most abundant of all vegetable productions requires only the labour of the husbandmen to collect its harvest. The ironwood, solid as marble, furnishes the Otahetian with his long spear and massy club. The wild pine of Campeachy retains the rain water in its deep and capacious leaves, not less for the refreshment of the tree itself, than of the thirsty native of a burning soil. The cocoa of the East and West

India answers many of the most useful purposes of life to the natives of a warm climate. Its bark is manufactured into cordage and cloathing, and its shell into useful vessels; its kernel affords a pleasant and nutritive food, and its milk a cooling beverage; its leaves are used for covering houses, and are worked into baskets; and its boughs are of service to make props and rafters. The rain-deer of the Laplander, so essential to his support and subsistence, could not survive through the tedious winter, without the lichen rangiferinus, which he digs from beneath the snow. On the bleak mountains of the north, the pine, the fir, the cedar, and many of the resinous trees grow, which shelter man from the snows by the closeness of their foilage, and furnish him in winter with torches and fuel for his fire-side. The leaves of those evergreen trees are filliform, and thus are adapted to reverberating the heat, and resisting the violent winds which beat on elevated situations.—All these productions, and the various trees which produce cork and emit rosin, turpentine, pitch, gums, and balsam, either supply some constant necessity, obviate some inconvenience, or contribute to some use or gratification of the natives of the soils where they grow, or of the inhabitants of distant climates.

SECT. VI.—*Of Animals.*

WE are now come to consider the last, the noblest, and the most beautiful part of the creation; the creatures for whom this earth seems to have been entirely formed, and for whose repast or use the whole of its unintelligent productions appear to have been brought forth; these are the animated tenants of our globe.

When we compare animals and vegetables together, each in their most perfect state, nothing can be easier than to distinguish them. The plant is confined to a particular spot, and exhibits no mark of consciousness or intelligence; the animal, on the contrary, can remove at pleasure from one place to another, is possessed of consciousness, and a high degree of intelligence. But on approaching the contiguous extremities of the animal and vegetable kingdom, these striking differences gradually disappear, the objects acquire a greater degree of resemblance, and at last approach each other so nearly, that it is scarcely pos-

able to decide whether some of those species, which are situated on the very boundary, belong to the animal or vegetable kingdom. Indeed we find the vegetable, animal, and mineral kingdoms so closely connected, like the links of a chain, that there is no possibility of finding a disjunction in any part, nor saying with precision where the one ends and the other begins, so nearly do they approach each other in the extremes of each class.

The term animal, in a general sense, is applied to every thing that is supposed to be alive to the sensations of pain and pleasure. Under the name of animal, therefore, are included men, quadrupeds, birds, fishes, reptiles, and insects. Animal literally means a *living thing*; but plants live. Linnæus has formed a climax of the grand departments of creation. Stones grow; vegetables grow and live; animals grow, live, and feel.

Various are the corporeal forms, and great are the peculiarities of organization of the different animals which inhabit the globe; and equally various are their intellectual powers; beginning with man, who forms the highest link in the chain, and descending by an almost imperceptible diminution of mental powers, through an innumerable series of existences, and ending at last in mere animation alone, with a seeming privation of all mental perception whatever.

As an animal, man is strikingly distinguishable from the rest of the creatures of the earth, on account of the ingenuity with which he employs the productions of nature for his accommodation and comfort. He is also particularly distinguishable by the originality of his ideas. Instincts, in common with brutes, make up a part of his character; but he is principally the creature of experience and reflection. When an infant comes into the world, it is the most helpless of all creatures; no danger alarms it, nor can it make the smallest effort to preserve itself.— A tiger may approach it without occasioning terror; nor would it attempt to screen itself when the lion's mouth is opened to devour it. The voice of the mother is not understood for many weeks; and it is but by slow degrees that it acquires knowledge, in consequence of the gradual development of its reasoning faculties; but as its progress is more slow, so its ultimate attainments are proportionally greater than that of other animals. The chicken, within the first eight days of its life, seems to

have made nearly the whole mental acquirements it is ever capable of attaining; but no period of human life can be assigned when the mental progress of man is at a stand.—Man alone is able to form an idea of an abstract proposition, or to reason about distant occurrences. He alone can reason from consequences to remote causes, and can from the creature trace an idea of the Creator. A sense of religion, then, is the characteristic peculiarity which decisively marks a separation between man and all other animals.

But as the understanding of man, and the structure of his frame, will occupy the following sections, we will in this confine ourselves to a view of the other parts of animated nature.

Animals, like vegetables, differ in their sizes and powers, with respect to the places of their growth. Those produced in a dry sunny soil, are strong and vigorous, though not luxuriant: those again produced in a warm and moist climate are luxuriant and tender, and much larger than those produced in other countries; as in the internal parts of South America and Africa, particularly in the former place, where the earth-worm is near a yard long, and an inch thick; the serpents sometimes forty feet in length; the bats as large as rabbits; toads bigger than ducks; and the spider equal in size to the English sparrow. But in the frozen regions of the north, animals are scarce; and what few there are, except the bear, are not above half the size of those in the temperate zone.

Animals are also found to vary considerably according to their food or climate; and there are but few of the animal kingdom, (and these are they that are the most useful) which are found capable of attending man in his peregrinations over the globe. In uncultivated nature, the animal kingdom exceeds the vegetable; but, in a state of improvement, the interest of man, so directs it, that the vegetable kingdom should gain the ascendancy; for, on a review of the animal and vegetable world, we find but few animals which are intrinsically serviceable to man: while, on the other hand, numbers of them are noxious to his food, and inveterate enemies to his interest. But among the vegetable world, very few are noxious; and the greater part of them yield either food, medicine, or some other valuable article. Therefore, it always has, and will

remain to be, the interest of man, to diminish the number of animals, and increase that of vegetables; and in assistance to his endeavours, Providence has wisely ordered it that one animal shall subsist on another; for were they to live entirely on vegetables, myriads would soon become extinct for want of support.

The number of animals, which are immediately serviceable to man, (exclusive of the smaller, among the birds and fishes, which serve for food) does not extend to one hundred; while we are acquainted with no less than twenty thousand; and even this great number comprehends but a small portion of animated nature. Not only the earth, air, and sea, teem with myriads of living creatures, but also every vegetable, and each single leaf, is covered with an endless number of inhabitants, whose various forms, and properties have afforded matter of astonishment to the microscopic observer.

Animals are nourished by food, taken in at the mouth, digested in the stomach, and thence, by fit vessels, distributed over the whole body; but of the process by which the various vegetable productions, which form the food of a large portion of animals, is converted into part of the animal, we are totally ignorant. That this change does take place we know, but in what manner we know not any more than the animals themselves do, whose natural organs perform unknown to them the functions that are necessary for producing these changes.

The greatest part of animals have five senses, viz. seeing, hearing, smelling, tasting, and feeling. These, and the way of nourishment of animals, we shall more particularly consider, as they are common to man with beasts, in the following section.

Animals are generally divided into male and female, and some are both male and female, and are called hermaphrodites, as the earth-worm, and some others. With regard to their manner of propagation, they are divided into *oviparous*, bringing forth eggs; and *viviparous*, bringing forth their young alive.

Linnæus divides animals according to their internal structure. Some have the heart with two ventricles, and hot, red blood: viz. Quadrupeds and birds; others have the heart with one ventricle, and cold, red blood, viz. Amphibia and fishes; the former being furnished with lungs, and the fishes with gills. Some have the heart with

one ventricle, and cold, white serum, viz. Insects and worms; the former being furnished with feelers, and the latter with holders. All quadrupeds, which have teats, are distinguished by their teeth. These form the following seven orders: The Primates or Principals, which have four cutting teeth in each jaw; the Brutæ or Brutes, which have no cutting teeth; the Feræ or Wild Beasts, which have generally six cutting teeth in each jaw; the Glires, or Dormice, which have two cutting teeth both above and below; the Pecora, or Cattle, which have no cutting teeth above, and six or eight below; the Belluæ, or Beasts, properly so called, with the fore teeth blunt; and the Cetæ, or those of the Whale kind, which have cartilaginous teeth. This is the brief outline of this celebrated naturalist's arrangement, the names of the different animals, and their respective classes, occupying no less than two large octavo volumes; but the natural division of animated nature is universally allowed to be the five following classes; Quadrupeds, birds, fishes, insects, and amphibious animals; though it must be confessed that this distribution is not exactly defined by nature; as there are many animals whose forms and qualities render it difficult to reduce them to any one of these classes.

I. *Quadrupeds.*—Quadrupeds are a large and useful class of animals, whose generic characters are these; their bodies are covered with hair; they have four feet; they are viviparous; and the females suckle their young.

Quadrupeds are the most important creatures to man, and deserve his attention more than the inhabitants of either the air or the water. They inhabit the same soil with man; and among them are found beings possessing a greater share of instinct than the inhabitants of either air or water; they breathe through their lungs like the human species; like these they are viviparous: they have also warm red blood circulating through their veins; and, however mortifying the reflection to human pride, many of them, both in their internal and external form, bear a strong resemblance to man: the interior structure of some of the ape kind, so nearly resembles that of the human kind, that anatomists can scarcely discover where the peculiarity exists.

Though the characters of quadrupeds are so obvious, yet as all the parts of nature are united together to form one grand whole, there are several species, which seem to be of an equivocal nature, and which form the links uniting different animals together; as the bat and porcupine, the former of which possesses wings, and the latter quills, like birds; the armadillo is covered with a hard shell, by which it seems to partake of the nature of insects or snails; and the seal and the morse, though evidently of the quadruped kind, are furnished with fins, and reside almost constantly in the water.

Quadrupeds, like all other animals, are wisely adapted by Providence to their respective situations and natures. Those which turn up the ground in pursuit of their food, have sharp snouts; others, which require a keener scent, as dogs, particularly those of the chace, having long noses, whereby the olfactory nerves are more perfect; while others, of a rapacious nature, have short thick noses, whereby their jaws have a greater muscular power, as those of the lion; and all granivorous animals have a strong tendinous ligament, extending from the head to the middle of the back, to enable them to hold down their heads to the ground; the fore teeth of these animals are also edged, for the purpose of cutting their food; but those of carnivorous animals are sharp, and serve rather as weapons of offence. In both, however, the surfaces of the grinding teeth are unequal and jagged, locking into each other when the jaws are brought into contact. The stomach of carnivorous animals is also small and glandular; and affords such juices as are best adapted to digest and macerate its contents; but those animals which subsist on a vegetable diet, have four stomachs: all which serve as so many laboratories to prepare the food for the nourishment of the body: and, in general, granivorous animals, whose food is easily procured, have large capacious stomachs, and capable of great dilation; whereas carnivorous creatures have the stomach more contracted, and the intestines curtailed, whereby they are enabled to subsist for a longer time without food. Strong large animals, which are neither formed for pursuit nor flight, as the elephant, rhinoceros, sea-horse, &c. have thick massy legs to support their unwieldy bodies. While deers, hares, and other creatures, whose safety depends on flight,

and who are beset by numberless enemies, have long, slender, but muscular legs. Those formed for a life of rapacity, have their feet armed with sharp claws, which in some species are retractile, as those of the cat; and, on the contrary, peaceful animals are generally furnished with hoofs, which often serve as weapons of defence; and the feet of those which subsist on fish, have membranes between the toes, the better to enable them to pursue their prey in the watery element.

The larger species of quadrupeds are in general the most harmless and inoffensive; and, as if sensible of their own innocence, they possess the most courage; while the more rapacious animals are inferior to those in size, and also in courage; and, except the dog, there is no carnivorous quadruped that will voluntarily attack another animal when the odds is against him. Thus nature has furnished the most inoffensive animals with superior size and strength; and opposed to them the carnivorous kinds, which possess more cunning and agility, whereby an equilibrium is preserved between the numbers of the different kinds.

The carnivorous animals are in general confined to their retreats during the day, and commit their depredations by night; when the forest resounds with the tremendous roar of the lion; the hideous yell of the tiger; the barking of the jackal; the dismal cry of the hyæna; and the hissing of the serpent. Most of these kinds of animals take their prey by surprise from some ambush, where they lay in wait, more than by a regular pursuit. There are some, however, which pursue in companies, mutually encouraging each other by their cries, as the jackal, syagush, wolf, and dog. Carnivorous animals will sometimes devour the lesser rapacious species; but they generally prefer the flesh of granivorous creatures, and commit their devastations among the peaceful domestic flocks and herds. The most defenceless creatures have different methods of providing for their safety. Some find protection in the holes they form in the earth; others are enabled to escape their pursuers by flight; others, again, unite for their mutual defence, and gain by numbers, what they want individually in strength; and, lastly, others avoid their enemies, by placing some of their own company as centinels, to warn them of the first approach of danger; a duty in which they are seldom negligent,

and for the neglect of which they are invariably punished by the rest.

II. *Birds.*—Birds, next to quadrupeds, seem to demand our attention. The generic characters of this class of animals are these; the body is covered with feathers, and furnished with two legs, two wings, and a hard horny bill; and the females are oviparous.

Birds are infinitely more numerous in their different kinds than quadrupeds; but still less so than fishes.—They seem designed by Providence for a solitary life; and though inferior to the brute creation in the powers of attack and defence, they possess a greater faculty of escape; and the greater part of them immediately elude their enemies of the quadruped and reptile nature, by an aerial escape: for which all parts of their bodies seem admirably adapted; the external form of the body being sharp before, swelling gradually, and terminating in a large spreading tail, which renders it buoyant, while the fore part cleaves the air.

The clothing of these animals is exactly suited to their manner of life. The feathers all tend backwards, and neatly, and closely fold over each other, which answer the triple purposes of warmth, speed, and security. Those placed next the skin are furnished with a warm soft down; while the exterior ones are arrayed with double beards, longer at one end than the other, and which consist of thin little laminæ, disposed in regular lines, and perfectly even at their edges. The shaft of each feather is formed of a thin hollow tube, which answers the purposes of strength and lightness; the upper part being filled with soft pith, to afford nourishment to the beards. They are so placed, that the largest and strongest, are those of the wings and tail, have the greatest share of duty to perform in flight. The upper external side of each single filament, in the beard of the feather, is furnished with hairs on its edges, which lock into those of the next filament, and thus form an entire, but light, smooth surface. Birds are also furnished with certain glands upon their rumps, which contain a quantity of oil, which they press out with their beaks, and rub over their feathers, in order to smooth them, and enable them to turn off the water. Aquatic birds, as the duck, goose, &c. have a greater quantity of this oil; but those who live principally under cover, and

and seldom expand their wings, have a less proportion of it; as the common hen, whose feathers are impervious to every shower of rain.

Birds possess a perfection of sight far superior to that of either man or brute, which is necessary for their safety and support. Were it less perfect, birds of rapid flight would strike against every object in their way; and be unable to discover their proper food at a distance. The kite darts on its prey from the greatest heights to which it ascends; and the hawk will discover a lark at a distance too great for human perception.

Aquatic birds have webbed feet, or membranes between their toes, to assist them in swimming; other birds have their toes disjoined, the better to enable them to catch their prey, or cling to the branches of trees. Birds, with long legs, have also long necks, to enable them to pick up their food; but some aquatic birds, as the swan and goose, have long necks and short legs.

Birds are destitute of urinary bladders, yet they have large kidneys and ureters, by which the secretion of urine is performed, and then carried away with the other excrements, in one common canal; by which means they are less obnoxious to diseases than quadrupeds, who drink much, and have a separate passage for the ejection of the fluid excrement.

The greater number of birds pair at the approach of spring; and the compact entered into is inviolably observed, for that season at least; but some species enter into this connection for years, and even for life.

All birds are oviparous, and the hens of some species will lay eggs though they be not accompanied by the male; as the common domestic hen; but eggs of this kind are always sterile, never producing live animals. Every bird builds its nest in such a manner, and with such materials, as best answer its own purpose and situation; thus the wren, which lays a great number of eggs, requires a very warm nest, as her body is not sufficiently large to cover the whole of them; but the crow and eagle are less solicitous in the warmth of the nest, as the small number of eggs they lay, and largeness and heat of their bodies, afford the eggs sufficient warmth. The same bird also, when in a cold climate, lines its nest with more care and warmer materials than in a warmer climate. The male likewise of most birds, during the season of incubation,

supplies the place of the female, in her absence from the eggs; and supplies her with food during the time of her sitting.

Those birds which are hatched early in the season, always prove more vigorous and strong than such as have been delayed till the middle of summer. The number of eggs which a bird will lay cannot be exactly ascertained; but it is well known that a female bird, which would have laid but two or three eggs at most, will, on her eggs being removed, lay above ten or a dozen. A common hen, if properly fed, will produce above a hundred eggs, from the beginning of spring to the end of autumn. Nature has wisely ordered it, that the smallest and weakest birds, and, in general, all those which are most serviceable to man, are the most prolific, while the strong and rapacious kinds are marked with sterility.

Birds are, in all countries, longer lived than the brute creation; the linnet will often live fourteen or fifteen years; the bullfinch twenty; the goose fourscore; while swans, eagles, and some others, have been known to live two, or even three hundred years.

The number of species of birds, which mankind has rendered domestic, are but few, as the peacock, turkey, common hen, guinea hen, pigeon, swan, goose, duck, and guinea duck, being only nine, while the number of all the species known exceed fifteen hundred.

III. *Amphibious Animals* are all those who are capable of living either on land or in the water. They are furnished with lungs and air bladders, adequate to this purpose. Such are the frog, castor, otter, tortoise, sea calf, alligator, &c.

Numbers of insects, particularly the fly kind, appear to be amphibious, gnats always drop their eggs in water, where the young are hatched, and live after the manner of fishes; till at length they undergo a metamorphosis, taking wing, quit their natural element, and become inhabitants of the air.

IV. *Fishes.* Fishes are a class of creatures that appear both in structure and sagacity quite inferior to other animals; though capable of enduring famine an amazing length of time, they appear most voracious creatures; a ceaseless desire for food seems the ruling impulse of their

actions, and their life one continued scene of violence or evasion.

Most fishes present the same external form; sharp at both ends, and bulky in the middle; which shape is most convenient for their passage through the watery element. Mankind have imitated this form in the construction of their marine vessels; but the progress of such machines is far inferior to that of fishes; any of which, will, with ease, outstrip a ship in full sail; play around it, loiter behind, and overtake it.

The instruments of motion in these animals are the fins; of which the general complement is two pair, and three single fins; though some fishes possess more, and many less than this number. The pectoral fins are placed at some distance behind the opening of the gills; and are generally strong and large; answering the same purpose, to a fish, as wings do to a bird in the air; namely, pushing the body forward, like the oars to a boat. They also serve to balance the body of a fish, and prevent the head from sinking, which it would otherwise do. The ventral fins are placed under the belly, towards the lower part of the body; these are always extended flat on the water, in all situations; and serve to rise or depress the body of the animal, rather than assist his progression. The dorsal fin is situated along the ridge of the back; and serves to keep the fish in equilibrium, and also assists it in its velocity. This fin is very large in all the fish; the pectoral fins of which are proportionably less. The anal fin extends from the anus to the tail, and serves to keep the body of the animal upright, or in a vertical direction. In some fishes, as before observed, the tail is horizontal, and in others perpendicular. Thus equipped, these animals have the most rapid motions; and perform voyages of upwards a thousand leagues in one season.

Fish are also furnished with a slimy glutinous matter, which overspreads the whole body, and defends them from the corrosive quality of the water. Beneath this matter, some have a strong covering of scales, which, like a coat of armour, protects the body from injuries. Beneath which, again, there is an oily substance which supplies the animal with the necessary warmth and vigour.

Fishes possess most of the senses, in an inferior degree, to land animals. Their sense of smelling (though furnished

with nostrils) is less perfect that in the other parts of animated nature, as must be evident from the nature of the fluid they inhabit: this sense in them can only act from the action of the fluid, tinctured with the odour of the object upon the olfactory nerves within, in the same manner as the palates of other animals discover tastes. Their sense of taste must also be very imperfect; their palate being of a hard bony nature; whereas, in quadrupeds who possess this sense in an exquisite degree, this organ is very soft and pliant. From this indiscrimination, fish will frequently swallow the plummet, as well as the bait.—Their sense of hearing is still more defective, if they possess this faculty at all, as is evident from the frequent experiments which have been made. No fish, except the whale kind, have the least appearance, on dissection, of any auditory organs. Their sense of sight, is, however, somewhat more perfect, though inferior to that of most other animals. They are totally destitute of eye-lids; the eyes being covered with the same skin that overspreads the rest of the body.

The period to which fishes live, is very little known, though it is generally believed they attain to a considerable age; some of the least exceed in their age that of a man. The method of discovering their ages, is either by examining the transverse coverings of their scales, by means of a microscope, or by the transverse section of the back bone. Buffon found a carp, which by the former method of computation appeared to be a hundred years old, allowing one year for every covering of the scales; the skate and ray, like other fish which have no scales, have their ages discovered by separating the joints of the back bone, and then examining the number of rings which the surface exhibited where it was joined, allowing one year for each ring. Little can be said in favour of the certainty of either of these methods; they, however, though not infallible criterions, enable us to make a near approximation to the truth.

The greatest singularity in fishes, is their amazing fecundity. Some are viviparous, and others oviparous; the latter produce their young, or rather their eggs, in far greater abundance than the former; but at the same time they are more subject to become the prey of other fish, and even of their own species, not excepting the parent itself which exuded them, while they continue in their egg

state; consequently but very few of these eggs produce live animals, though produced in such considerable numbers. A single cod will produce above nine millions of eggs in one season; and many other fish have as proportionable an increase.

V. *Insects.*—Insects and animals of the worm kind seem to form the lowest order among the various tribes of living creatures which inhabit our globe. The distinguishing characters of insects are, that their bodies are covered with a sort of bony substance instead of skin, and their heads furnished with antennæ or horns. An insect may more particularly be defined a small animal without red blood (this matter being white and cold), bones, or cartilages; furnished with a trunk, or else a mouth, which opens lengthways, contrary to the natural order; the eyes destitute of covering; and lungs opening on the sides of the body. This definition will comprehend the whole class of insects of every description. This class of beings is so numerous and so various as to exceed the most accurate and unwearied observations. To give the different species of only flies and moths would be a fruitless attempt; but to give the history of every species of insect would be utterly impracticable, so various are they in their forms, sizes, habitudes, methods of propagation, and manners and duration of life. A general division of them, however, according to their most apparent external differences of form, may be attempted.

The first class of these beings which present themselves to our observation, appear to be those which are destitute of wings, and are seen crawling about on every plant and spot of earth. Some of these never acquire wings, but continue in this reptile state during their whole lives. These are all oviparous, except the flea and the wood-louse; and properly constitute the first division of insects. Others which hereafter become winged insects, belonging to the following divisions.

The second grand division of insects are those furnished with wings; but which, when first produced from the egg, appear like reptiles, and have their wings so cased up, as to be quite concealed; but when these cases break, the wings expand, and the animal acquires its perfect form and beauty. Of this nature are the dragon-fly, the grasshopper, and the ear-wig.

The third order of insects are those of the moth and the butterfly kind; which have all four wings each, covered with a mealy substance of various colours, which easily rubs off, and when examined by the microscope appears to be elegant scales. These insects have a peculiar method of propagation; they are oviparous, and, when first hatched from the egg, are perfect caterpillars, which often shed their skins, and, after having divested themselves of their skins for the last time, assume new coverings called chrysalides, in which state they continue till they come forth in their perfect winged forms.

The fourth division include those winged insects which originate from worms, and not from caterpillars, like the former, though they undergo similar transformations. Some of these are furnished with two, and others with four wings each The wings of animals of this class differ from those of the moth and butterfly kind, in being destitute of those scales with which these are furnished. This class includes all the numerous class of flies, gnats, beetles, bees, &c.

The fifth and last class of insects contain those which naturalists have termed zoophytes, and are distinguished by their peculiar mode of propagation, so different from the ordinary course of nature. They may be multiplied by dissection; and some of them, though cut in a hundred pieces, will still retain the vital principle in each separate part, each part shortly becoming a perfect animal; which may again be increased in the same manner. To this class belong the polypus, the earth worm, and all the varieties of the sea nettle.

Insects are furnished with all the necessary appendages proper to each, for the purposes of defence, of flight, or providing for their own subsistence. The different parts of their bodies are also constructed with admirable skill. The eye, for instance, is differently formed from that of any other creature: it is externally rigid, whereby it is not obnoxious to many injuries; the cornea is divided in every part into lenticular facets, which, viewed by the microscope, appear like a beautiful piece of lattice work, each opening reflecting the rays of light, so that, when looked through, the object appears inverted, and thereby supplies the place of crystalline humour, of which insects are entirely destitute. Larger animals are obliged to turn their eyes towards the object they wish to behold;

but many insects, as flies, have their eyes so constructed as to admit the view of every neighbouring object at once. The number of eyes are very different in different insects: some have only one; others have two; spiders have generally eight; and flies have as many as there are perforations in the cornea, which are very numerous. Most insects are furnished with two antennæ, or feelers, which serve to keep their eyes clean. Amphibious insects have their feet formed of flat joints; and gristles placed on each side of the extremity of the limb, which supply the place of oars, as in the water-beetles. Insects formed for leaping, as the cricket and grasshopper, have strong, brawny, muscular legs; while those who use their claws in perforating the earth, have these members admirably adapted for this purpose.

Insects and reptiles, though seemingly the most insignificant of animated beings, have an important part assigned them to perform in this universe. Though the duration of their life be but as a moment, and their strength, when compared with that of the larger animals, as nothing, yet their power is often irresistible. The strongest animal which treads the earth is frequently driven to madness by the endless irritation these insignificant beings produce; the sun himself is deprived of his light by the shading of their wings, and every leaf that can give support to animal life is often swept, at once, away by their devouring jaws; neither has the ingenuity of man, which subdues the strongest, and reclaims the most ferocious animals, enabled him to devise the means of defending himself from the devastations of these active invaders of his rights. His very existence itself, on many occasions, depends upon his speedy withdrawing beyond the sphere of their active incursions.

If their power be thus irresistible, their utility is not perhaps less conspicuous on this globe. Man has ever been able, on some occasions, to make them become subservient to his will. The bee collects honey for his use; the moth, under his influence, affords him silk; the cantharides an active drug; the cochineal insect the most brilliant of his dyes. Even where they are totally beyond his controul, they minister indirectly to his wants. Under the form of eggs, maggots, grubs, caterpillars, aureliæ, and flies, they furnish food to innumerable creatures, who augment his comforts in a thousand ways. But it is as

the scavengers of this universe that these puny beings become chiefly salutary to man, and all animated nature. Without their unceasing aid in this respect, the air would become quickly tainted with the most noxious effluvia, which would soon put an end to animal existence. To obviate this, the beneficent Creator hath decreed, that a numerous department of this class of beings, while in their reptile state, shall be unceasingly employed in searching for and devouring every thing that has once lived, and is now tending to decay. Under this state of degradation these creatures are doomed to labour for a time with unceasing assiduity: and that nothing might divert their attention from this important business, even for one moment, the distinctions of sex are withheld from them while in this state; nor does it seem that they have a single perceptive faculty, unless it be that of striving to preserve their existence, and allay their insatiable appetite for food. Having at length, however, with the most patient assiduity, performed the menial task that was assigned them, they are then called, by the bounty of the Creator, into another and superior state of existence, in which they are destined to perform a part the most opposite which can be conceived to that they formerly acted. The unsightly grub, after a temporary death, awakens into new life, and deserting the clod it lately inhabited, and nauseating its former food, sports in the sun beam, and sips the balmy dew; nor does the butterfly, now arrayed in the most gorgeous attire, seem to claim the most distant alliance with the ugly caterpillar from whence it sprang. The attraction of sex seems to form the chief business of this period of life; food is neglected as if unnecessary, and its life is devoted to amorous dalliance alone. Having soon provided a numerous progeny of voracious labourers, it leaves this transitory scene to make room for those who are destined to supply its important place in the universe.

The changes and transformations of insects are first from the *ovum* (egg) into the *larva* (caterpillar or maggot), then into the *pupa* (chrysalis), and last into the *imago* (fly). *Pupa* is a name derived from the resemblance of the insect in this state to an infant in swaddling cloaths, and the term is now used in preference to *chrysalis*. The period of existence in each of these states varies greatly

in different species of insects; but in general they continue much longer in the reptile state than that of the fly. The species of fly called ichneumon remains in the water as a kind of worm for the space of about two years; in its fly state it seldom continues more than one day. The ephemeron is nearly the same; and the grub of the cockchaffer remains under ground for about two years also; in its fly state it in general exists only about two months.

Sect. VII.—*Of the Human Frame.*

Man is placed at the head of the animal creation. Animated and enlightened by a ray from the Divinity, he surpasses in dignity every material being. He was made after all other creatures, not only as the most perfect, but as the superintendent and master of all things; created "to rule over the fish in the sea, and over the fowl of the air, and over cattle, and over the earth, and over every creeping thing."

The body of a well-shaped man ought to be square, the muscles ought to be strongly marked, the contour of the members boldly delineated, and the features of the face well defined. In women, all the parts are more rounded and softer, the features are more delicate, and the complexion brighter. To man belong strength and majesty; gracefulness and beauty are the portion of the other sex. Every thing in both sexes points them out as sovereigns of the earth; even the external appearance of man declares his superiority to other living creatures. His head tends towards the heavens, and in his august countenance beams the sacred ray of sapient reason. He alone sheds the tears which arise from emotions of sensibility, unknown to animals; and he alone expresses the gladness of his soul by laughter. His erect posture and majestic deportment announce his dignity and superiority. He touches the earth only with the extremity of his body; his arms and hands, formed for nobler ends than the correspondent organs of quadrupeds, execute the purposes of his mind, and bring every thing within his reach which can minister to his wants and his pleasures. By his eyes, which reflect the intelligence of thought, and

the ardour of sentiment, and which are peculiarly the organs of the soul, are expressed the soft and tender, as well as the violent and tumultuous passions. They are turned, not towards the heavens, but to the horizon, so that he may behold at once the sky which illuminates, and the earth which supports him. Their reach extends to the nearest and the most distant objects, and glances from the grains of sand at his feet to the star which shines over his head at an immeasurable distance.

The human body consists of solid and fluid parts, which in general are called the *solids* and *fluids*, or *humours* of the body. The solid parts are *bones*, *cartilages*, *ligaments*, *muscles*, *tendons*, *membranes*, *nerves*, *arteries*, *veins*, *ducts*, or fine tubular vessels of various sorts. Of these simple solids the more compound organs of life consist, viz. the *brain* and *cerebellum*, the *lungs*, the *stomach*, the *liver*, the *spleen*, the *pancreas*, the *kidneys*, the *glands*, the *intestines*, together with the organs of sense, viz. the *eyes*, the *ears*, the *nose*, and the *tongue*.

The fluid parts of the human body are *chyle*, *blood*, *saliva* or *spittle*, *bile*, *milk*, *lympha*, the *semen*, the *pancreatic juice*, *urine*, *phlegm*, *serum*, and the *aqueous humour* of the eyes.

Anatomists have employed much pains in the study of the material part of man, and have assigned to each of the above parts their appropriate use in the economy of his frame; but none, perhaps, have given so comprehensive and eloquent a description of the structure of man as the late Dr. Hunter.

"In order," says this celebrated anatomist, "to acquire a satisfactory general idea of this subject, let us, in imagination, *make* a man; in other words, let us construct a fabric fit for the residence of an intelligent soul. This soul is to hold a correspondence with all material beings around her; and to that end she must be supplied with organs fitted to receive the different kinds of impressions which they will make. In fact, therefore, we see that she is provided with the organs of sense, as we call them: the *eye* is adapted to light, the *ear* to sound, the *nose* to smell, the *mouth* to taste, and the *skin* to touch. Farther, she must be furnished with organs of communication between herself in the brain and those organs, to give her information of all the impressions that are made on them; and she must have organs between herself in

the brain and every other part of the body, fitted to convey her commands and influence over the whole. For these purposes, the *nerves* are actually given. They are chords which rise from the brain, the immediate residence of the mind, and disperse themselves in branches through all parts of the body. They are intended to be occasional monitors against all such impressions as might endanger the well-being of the whole, or of any particular part; and this vindicates the Creator of all things in having actually subjected us to those many disagreeable and painful sensations which we are exposed to from a thousand accidents in life. Moreover, the mind, in this corporeal system, must be endued with the power of moving from place to place, that she may have intercourse with a variety of objects; that she may fly from such as are disagreeable, dangerous, or hurtful, and pursue such as are pleasant and useful to her; and, accordingly, she is supplied with *muscles* and *tendons*, the instruments of motion, which are found in every part of the fabric where motion is necessary: but, to give firmness and shape to the fabric; to keep the softer parts in their proper place; to give fixed points for, and proper direction to, its motions; as well as to protect some of the more important and tender organs from external injuries, there must be some firm prop-work interwoven through the whole; and, in fact, for such purposes the *bones* were given. The prop-work must not be made into one rigid fabric, for that would prevent motion. Therefore, there are a number of bones*. These pieces must all be firmly bound together, to prevent their dislocation; and this end is perfectly answered by the *ligaments*. The extremities of these bony pieces, where they move and rub upon one another, must have smooth and slippery surfaces, of easy motion. This is most happily provided for by the *cartilages*, and mucus of the joints. The interstices of all these parts must be filled up with some soft and ductile matter, which shall keep them in their places, unite them, and at the same time allow them to move a little upon one another; and these purposes are answered by the *cellular membrane*, or adipose substance. There must be an adequate covering

* Dr. Keill reckons 245 bones in the human body; others make them to be 249, viz. in the skull 14, in the face and throat 40, in the trunk 67, in the arms and hands 62, and in the legs and feet 60.

over the whole apparatus, both to give it compactness, and to defend it from a thousand injuries; which, in fact, are the very purposes of the skin, and other integuments. Lastly, the mind being formed for society and intercourse with beings of her own kind, she must be endued with powers of expressing and communicating her thoughts by some sensible marks or signs, easy to herself, and capable of great variety; and accordingly she is provided with the organs and faculty of *speech*, by which she can throw out signs with amazing facility, and vary them without end.

"Thus we have built a body which seems to be pretty complete; but, as it is the nature of matter to be worked upon and altered so, in a very little time such a living creature must be destroyed, if there is no provision for repairing the injuries which she will commit upon herself, and those which she will be exposed to from without. Therefore a treasure of *blood* is actually provided in the heart and vascular system, full of nutritious and healing particles, fluid, and able to penetrate into the minutest parts of the animal; impelled by the *heart*, and conveyed by the *arteries*, it washes every part, builds up what was broken down, and sweeps away the old useless materials. Hence we see the necessity or advantage of the heart and arterial system. What more than enough there was of the blood to repair the present damages of the machine, must not be lost, but should be returned again to the heart; and for this purpose the *veins* are actually provided. These requisites in the animal explain, *a priori*, the *circulation* of the blood. The old materials, which are become useless, and are swept off by the current of the blood, must be separated and thrown out of the system: therefore the *glands*, the organs of secretion, are given for straining whatever is redundant, vapid, or noxious, from the mass of blood; and, when strained, they are thrown out by *emunctories*, called organs of excretion. But now, as the machine must be constantly wearing, the operations must be carried on without intermission, and the strainers must be always employed: therefore there is actually a perpetual circulation of the blood, and the secretions are always going on. Even all this provision, however, would not be sufficient; for that store of blood would be soon consumed, and the fabric would break down, if there were not a provision made for

fresh supplies. These we observe, in fact, are profusely scattered round her in the animal and vegetable kingdoms; and she is furnished with hands, the fittest instruments that could have been contrived, for gathering them, and for preparing them in a variety of ways for the mouth. But these supplies, which we call food, must be considerably changed; they must be converted into blood. Therefore she is provided with teeth for cutting and bruising the food, and with a stomach for melting it down; in short, with all the organs subservient to digestion. The finer parts of the aliments only can be useful in the constitution: these must be taken up and conveyed into the blood, and the dregs must be thrown off. With this view, the *intestinal canal* is actually given. It separates the nutritious part, which we call *chyle*, to be conveyed into the blood by the system of the *absorbent vessels;* and the feces pass downward out of the body. Thus we see that, by the very imperfect survey which human reason is able to take of this subject, the animal man must necessarily be complex in his corporeal system, and in its operations; and in taking this general view of what would appear, *a priori*, to be necessary for adapting an animal to the situations of life, we observe, with great satisfaction, that man is accordingly made of such systems, and for such purposes. He has them all; and he has nothing more, except the organs of respiration. Breathing it seemed difficult to account for *a priori;* we only know it to be a fact essentially necessary to life. Notwithstanding this, when we see all the other parts of the body, and their functions, so well accounted for, and so wisely adapted to their several purposes, there would be no doubt that respiration was so likewise; and, accordingly, the discoveries of Dr. Priestley have lately thrown light upon this function also.

"Of all the different systems in the human body the use and necessity are not more apparent, than the wisdom and contrivance which has been exerted in putting them all into the most compact and convenient form; in disposing them so that they shall mutually receive and give helps from one another; and that all, or many, of the parts shall not only answer their principal end and purpose, but operate successfully and usefully in a variety of secondary ways. If we consider the whole animal mashine in this light, and compare it with any in which hu-

man art has exerted its utmost skill (suppose the best constructed ship that ever was built), we shall be convinced, beyond the possibility of doubt, that there exists intelligence and power far surpassing what human art can boast of. One superiority in the animal machine is peculiarly striking. In machines of human contrivance, or of art, there is no internal power, no principle in the thing itself, by which it can alter and accommodate itself to any injury that it may suffer, or make up any injury that admits of repair: but in the natural machine, or animal body, this is most wonderfully provided for by the internal powers of the machine itself; many of which are not more certain and obvious in their effects, than they are above all human comprehension as to the manner and means of their operation. Thus, a wound heals up of itself; a broken bone is made firm by a callus; a dead part is separated and thrown off; noxious juices are driven out by the emunctories; a redundancy is removed by some spontaneous bleeding; a bleeding naturally stops of itself; and a great loss of blood, from any cause, is in some measure compensated by a contracting power in the muscular system, which accommodates the capacity of the vessel to the quantity contained. The stomach gives information when the supplies have been expended; represents, with great exactness, the quantity and quality of what is wanted in the present state of the machine; and, in proportion as she meets with neglect, rises in her demand, urges her petition in a louder tone, and with more forcible arguments. For its protection, an animal body resists heat and cold in a very wonderful manner, and preserves an equal temperature in a burning and in a freezing atmosphere. These are powers which mock all human invention of imitation; they are characteristics of the Divine Architect."

Part of the motions of the complicated frame of man, in common with all animated beings, are *voluntary*, or dependent on the mind; and part *involuntary*, or without the mind's direction.

How the incorporeal existence, which we call *mind*, can operate on matter, and put it in motion, is to us perfectly incomprehensible. When the anatomist considers the number of muscles that must be put in motion before any animal exertion can be effected; when he views them one by one, and tries to ascertain the precise degree to

which every individual muscle must be constricted, or relaxed, before the particular motion indicated can be effected, he finds himself lost in the labyrinth of calculations in which this involves him: but when he considers that every one of these muscles must be constricted or relaxed to the precise degree that appertains to each, and no more, and at the same instant of time; when he recollects that the smallest jarring in this respect in any one of these would throw the whole into inextricable disorder; when he considers with what promptitude the whole of this is done in an instant by the mere act of his volition, and how, in another instant, by a change in that volition, all these muscles are thrown into a different state, and a new set brought into action, and so on continually as long as he pleases, his mind is lost in the immensity of wonder that this excites. But when he farther reflects, that it is not only he himself that is endowed with the faculty of calling forth those incomprehensible energies, but that the most insignificant insect is vested with powers of a similar sort, he is still more confounded. A skilful naturalist has been able to perceive, that in the body of the poorest caterpillar, which, in the common opinion, is one of the most degraded existences on this globe, there are upwards of two thousand muscles, all of which can be brought into action with as much facility at the will of that insect, and perform their several offices with as much accuracy, promptitude, and precision, as in the most perfect animal; and all this is done by that insect with an equal consciousness of the manner how, as the similar voluntary actions of man are affected.

Nor are the involuntary motions less mysterious and wonderful. The stomach, the intestines, and all the functions necessary to life, wait not to be called into action by any volition of ours. The heart, placed near the centre of the system, performs its task as well when we are asleep as when we are awake, by night as by day, and like an unwearied and faithful labourer, with muscular exertions, distributes the vital stream through our complicated frame, till their wearied functions cease, and the tenement of clay is inhabited no more. How admirably it is calculated to keep up this continued circulation throughout the system, may be understood by the following computation, by Dr. Keill: Each ventricle will at least contain one ounce of blood. The heart contracts

four thousand times in one hour; from which it follows, that there pass through the heart, every hour, four thousand ounces, or three hundred and fifty pounds of blood. Now the whole mass of blood is said to be about twenty five pounds; so that a quantity of blood equal to the whole mass of blood passes through the heart fourteen times in one hour, which is about once every four minutes." Consider what an affair this is when we come to very large animals. The aorta of a whale is larger in the bore than the main-pipe of the water-works at London-Bridge; and the water roaring in its passage through that pipe, is inferior in impetus and velocity to the blood gushing from the whale's heart. Hear Dr. Hunter's account of the dissection of a whale. "The aorta measured a foot diameter. Ten or fifteen gallons of blood is thrown out of the heart at a stroke, with an immense velocity, through a tube of a foot diameter. The whole idea fills the mind with wonder." It is thus, O great Author of all Things! we discover Thee in thy works.

Thus may the curiosity of man be gratified by surveying the productions of nature; and thus the farther he extends his researches, the more reason will he find to admire the general economy of created beings. Whatever objects his eyes behold, whether small or great, he will see design and order impressed upon them, in the most conspicuous characters. The stars scattered over the blue vault of heaven, and so numerous as to baffle calculation, whether they shine only to afford us light, or are the suns of other systems, and thus proclaim the extent of Almighty power, cannot fail to strike us with astonishment. The blazing *comets*, which were the dire prognostics, in the opinion of our ancestors, of the fall of kings, and the subversion of empires, we are taught by the improvements of philosophy to contemplate with admiration, devoid of terror; and to consider as the abodes of creatures endowed with various powers and faculties. The *earth* performing her annual and diurnal circuit around the centre of the system, so as to produce a regular change of seasons, and a succession of light and darkness: the *ocean* giving to mankind the constant advantages of its tides; and although frequently tempestuous, and sometimes

threatening to mix its waves with the clouds, and to overflow the earth, yet obeying the invariable laws of its flux and reflux, and never advancing beyond its prescribed bounds:—the *air*, which, from its partial pressure, would crush us to the ground, but by the elasticity of its internal resistance forming an exact counterbalance, clearly demonstrate the power, the wisdom, and the benignity of an omnipotent Creator. Time and space, substance and heat, are the vast materials of nature; the wide universe is the sphere in which they act; and life, activity, and happiness, constitute the end of their operations. The whole race of *animals* preserved to the present time in the same flourishing state in which they were at first created; the impulse of instinct directing them to wholesome food, to commodious habitations; and to the propagation of their kind; the structure of their frames, suitable to their immediate use; the several tribes of creatures subordinate to each other, conducive in various respects to the good of man; and the abundant provision made for their subsistence, are all evident and incontestible proofs of divine skill, contrivance, and power.

The human race, and all other beings, are formed with such exquisite ingenuity, that man is wholly unable to imitate the most simple fibre, vein, or nerve, much less to construct a hand, or any other organ of contrivance or execution. All living creatures constitute one chain of universal existence, from the beginning to the end of the world. Our own structure, and the formation of all around, above, and beneath us, in the animal, vegetable, and mineral kingdoms, proclaim the operations of an all-wise and all-powerful Being, and the constant agency of his over-ruling Providence.

It is thus we discover the Almighty Creator of all things in his works! Dark clouds rest upon his hallowed and inaccessible habitation: but the beams of glory darted from his eternal throne, shine around us on every side. We cannot with our mortal eyes behold his presence; we cannot even look stedfastly upon the orb of day, his glorious emblem: but we can in every part of the globe trace the plain vestiges of his power, wisdom, and benevolence.—Wherever a plant takes root and flourishes, wherever an animal appears, there is he plainly discoverable. In the depths of the Pacific Ocean, in the boundless wilds of Africa, upon the snowy summits of the Alps, and along

the vast range of the stupendous Andes, he may be traced. His power and wisdom are evident in the formation of the fragrant rose, and the towering oak; in the gentle lamb, and the roaring lion; in the melodious nightingale, and the rapacious vulture. The exquisite construction of their respective parts prove the unskilfulness of men, even in their most elaborate productions, and demonstrates the admirable invention of their Creator. Compared with his works, how small, imperfect, and trifling are all the labours of art! since all he does is marked with consummate skill and excellence. He has concealed from our strictest and most persevering examination a knowledge of their essence; and as that knowledge would neither minister more abundantly to our comforts, nor increase our happiness, his benevolence is displayed in what he denies as well as in what he bestows. In his hands matter is supple and prompt to receive every impression. At his command it is formed into beings, the most strongly marked by character, and the most varied by form, from the stern lineaments and shaggy covering of the lion, to the soft plumage and delicate shape of the dove. He has impressed a never failing symmetry upon every created being of the same species, and endowed it with the same properties; and this unchanging execution and perpetuity of his original design, proves to us the undeviating regularity of his plans. The same principles of fecundity produce each particular kinds of animals; and the same modes of preservation continue, as at the moment when by his creative voice they were first called into existence. The parents and the most distant offspring of animals are the same: preserving invariably through their successive generations the most exact resemblance of their original stock. The different kinds still continue unaltered in proportions, features, and strength, and they flourish in full youth, bloom, and vigour; and these are qualities not interrupted by the decay, nor weakened by the old age of their species. He has diversified the earth with hills and valleys, woods and plains, intersected it with rivers, lakes, and seas, affording to the eyes of man the most enchanting prospects, and the most beneficial means to supply the wants of his nature, and guard him against the inclemency of the seasons. He has clothed the surface of the earth with the refreshing verdure of grass, and the thick forests of stately trees; he has enriched it with such nu-

merous vegetables as are more immediately conducive to the sustenance of man; and has stored its bowels with those metals, which excite his industry, and minister to his accommodation. Foreseeing the adaptation of many of his productions to the support and the comfort of human life, he has provided them in abundance; his bounty to all creatures is like the mighty ocean, flowing in perennial streams for every age:—it is open to every eye, its treasures are enjoyed wherever they are sought, but its sources are unknown and unfathomable.

Our natural desire of acquiring knowledge is ever attended with a consciousness of our ignorance; and our pride is repressed at every step we take by the limited nature of our faculties, and the tardy progress of our utmost diligence. The history of nature, indeed, as far as our imperfect researches can extend to her general economy and laws, is the history of providential goodness to all created beings: as we enlarge our acquaintance with it, the more do we understand our peculiar obligations, as creatures endued with reason, and enlightened by the revelation of the divine will. Our knowledge, therefore, is only valuable as it leads to devotion, gratitude, and obedience, which constitute the due homage of wise and dependent beings.

By looking back through the long series of past ages, we ascend to the developement of the creative power of God, as the primary cause of all existence; and we observe the proofs of omnipotence again manifested in the most tremendous manner, when at the divine command the foundations of the deep were broken up, and the guilty race of men, except righteous Noah and his family, were overwhelmed in the general deluge; of which the monuments are spread over the whole globe, to perpetuate the remembrance of sin and its punishment. By looking around us, and surveying the wide prospects of nature, we see the Almighty supreme in majesty, love, and mercy.—Led by the light of science to survey the starry heavens, we behold him exercising these attributes in other worlds; and communicating the blessings of existence and providential care to other systems of creation.

Thus extending its eager views to the contemplation of objects so vast, so various, and so magnificent, our souls feel the narrowness of their faculties to comprehend the divine operations, and are overwhelmed in the contempla-

tion of infinite power and transcendent glory; which only the bright order of celestial beings—the angels and archangels, who encompass the eternal throne of God, can adequately conceive, or duly celebrate.

The pleasures which arise from tracing this power and goodness will doubtless become incomparably more exalted and refined, when the faithful followers of the Redeemer of mankind shall be admitted to the realms of heaven and glory, and our souls, disengaged from all earthly impediments, shall ascend above the stars, and resemble those angelic beings;—when the most accurate, most enlarged, and most interesting knowledge, will form a part of our eternal happiness;—when the restless mind of man shall no longer form wild and inconsistent theories to account for the formation of the globe; *but the volume of universal nature shall be unfolded to his astonished eyes;*—when the laws, which regulate all orders of created beings, shall be fully unfolded and clearly understood, and man shall learn the true constitution of the world he now inhabits, from the time when discordant matter held obeyed the word of the Almighty, and was called into harmony and order, to the last awful period of its existence!

CHAP. III.

LOGIC.

OF all human sciences, that concerning man is certainly the most worthy of man, and the most necessary part of knowledge. We find ourselves in this world surrounded with a variety of objects; we have powers and faculties fitted to deal with them, and are happy or miserable in proportion as we know how to frame a right judgment of things, and shape our actions agreeably to the circumstances in which we are placed. No study, therefore, is more important than that which introduces us to the knowledge

of ourselves. Hereby we become acquainted with the extent and capacity of the human mind; and learning to distinguish what objects it is suited to, and in what manner it must proceed in order to compass its end, we arrive by degrees at that justness and truth of understanding which is the great perfection of a rational being.

If we look attentively into things, and survey them in their full extent, we see them rising one above another in various degrees of eminence. Among the inanimate parts of matter, some exhibit nothing worthy our attention; their parts seem, as it were, jumbled together by mere chance, nor can we discover any beauty, order, or regularity in their composition. In others we discern the finest arrangement, and a certain elegance of contexture, that makes us affix to them a notion of worth and excellence. Thus metals, and precious stones, are conceived as far surpassing those unformed masses of earth that lie every where exposed to view. If we trace nature onward, and pursue her through the vegetable and animal kingdoms, we find her still multiplying her perfections, and rising by a just gradation, from mere mechanism to perception, and from perception in all its various degrees to reason and understanding.

But though reason be the boundary by which man is distinguished from the other creatures that surround him, yet we are far from finding it the same in all. Nor is this inequality to be wholly ascribed to the original make of men's minds, or the difference of their natural endowments. For if we look abroad into the several nations of the world, some are over-run with ignorance and barbarity, others flourish in learning and the sciences; and what is yet more remarkable, the same people have, in different ages, been distinguished by these very opposite characters. It is therefore by culture, and a due application of the powers of our minds, that we increase their capacity, and carry human reason to perfection. Where this method is followed, knowledge and strength of understanding never fail to ensue; where it is neglected, we remain ignorant of our own worth; and those latent qualities of the soul, by which she is fitted to survey this vast fabric of the world, to scan the heavens, and search into the causes of things, lie buried in darkness and obscurity.—No part of knowledge, therefore, yields a fairer prospect of improvement than that which takes account of the un-

derstanding, examines its powers and faculties, and shews the ways by which it comes to attain its various notions of things. This is properly the design of *Logic*, which may be justly stiled the history of the human mind, inasmuch as it traces the progress of our knowledge, from our first and simple perceptions, through all their different combinations, and all those numerous deductions that result from variously comparing them one with another. It is thus that we are let into the natural frame and contexture of our own minds, and learn in what manner we ought to conduct our thoughts, in order to arrive at truth, and avoid error. We see how to build one discovery upon another, and by preserving the chain of reasonings uniform and unbroken, to pursue the relations of things through all their labyrinths and windings, and at length exhibit them to the view of the soul, with all the advantages of light and conviction.

'But as the understanding, in advancing from one part of knowledge to another, proceeds by a just gradation, and exerts various acts, according to the different progress it has made, logicians have been careful to note these several steps, and have distinguished them in their writings by the name of the operations of the mind.—These they make four in number; and agreeably to that, have divided the whole system of logic into four parts, in which these acts are severally explained, and the conduct and procedure of the mind in its different stages of improvement, regulated by proper rules and observations. Now, in order to judge how far logicians have followed nature in this distinction of the powers of the understanding, let us take a short view of the mind, and the manner of its progress, according to the experience we have of it in ourselves, and see whether the chain of our own thoughts will without constraint lead us.

First, then, We find ourselves surrounded with a variety of objects, which, acting differently upon our senses, convey distinct impressions into the mind, and thereby rouse the attention and notice of the understanding. By reflecting, too, on what passes within us, we become sensible of the operations of our own minds, and attend to them as a new set of impressions. But in all this there is only bare *consciousness*. The mind, without proceeding any farther, takes notice of the impressions that are made upon it, and views things in order, as they present

themselves one after another. This attention of the understanding to the objects acting upon it, whereby it becomes sensible of the impressions they make, is called by logicians *perception*; and the notices themselves, as they exist in the mind, and are there treasured up to be the materials of thinking and knowledge, are distinguished by the name of *ideas*.

But the mind does not always rest satisfied in the bare view and contemplation of its ideas. It is of a more active and busy nature, and likes to be assembling them together, and comparing them one with another. In this complicated view of things, it readily discerns, that some agree, and others disagree, and joins or separates them according to this perception. Thus, upon comparing the ideas of two added to two with the idea of four, we at first glance perceive their agreement, and thereupon pronounce that two and two are equal to four. Again, that white is not black, and five is less than seven, are truths to which we immediately assent, as soon as we compare those ideas together. This is the first and simplest act of the mind, in determining the relation of things, when, by a bare attention to its own ideas, comparing any two of them together, it can at once see how far they are connected or disjoined. The knowledge thence derived is called *intuitive*, as requiring no pains or examination; and the act of the mind assembling its ideas together, and joining or disjoining them according to the result of its *perceptions*, is what logicians term *judgment*.

Intuition affords the highest degree of certainty; it breaks in with an irresistible light upon the understanding, and leaves no room for doubt or hesitation. Could we in all cases, by thus putting two ideas together, discern immediately their agreement or disagreement, we should be exempt from error, and its fatal consequences. But it so happens, that many of our ideas are of such a nature, that they cannot be thus examined in concert, or by any immediate application one to another; and then it becomes necessary to find out some other ideas, that will admit of this application, that by means of them we may discover the agreement or disagreement we search for.—Thus the mind wanting to know the agreement or disagreement in extent, between two inclosed fields, which it cannot so put together as to discover their equality or in-

equality by an immediate comparison, casts about for some intermediate idea, which, by being applied first to the one, and then to the other, will discover the relation it is in quest of. Accordingly it assumes some stated length, as a yard, &c. and measuring the fields, one after the other, comes by that means to the knowledge of the agreement or disagreement in question. The intervening ideas, made use of on these occasions, are called *proofs;* and the exercise of the mind in finding them out, and applying them for the discovery of the truths it is in search of, is what we term *reasoning*. And here let it be observed, that the knowledge gained by reasoning is a deduction from our intuitive perceptions, and ultimately founded on them. Thus, in the case before-mentioned, having found by measuring, that one of the fields makes three score square yards, and the other only fifty-five, we thence conclude that the first field is larger than the second. Here the two first perceptions are plainly intuitive, and gained by an immediate application of the measure of a yard to the two fields, one after another.—The conclusion, though it produces no less certain knowledge, yet differs from the others in this, that it is not obtained by an immediate comparison of the ideas contained in it one with another, but is a deduction from the two preceding judgments, in which these ideas are severally compared with a third, and their relation thereby discovered. We see, therefore, that reasoning is a much more complicated act of the mind than simple judgment, and necessarily presupposes it, as being ultimately founded no the perceptions thence gained, and implying the various comparison of them one with another. This is the great exercise of the human faculties, and the chief instrument by which we push on our discoveries, and enlarge our knowledge. A quickness of mind to find out intermediate ideas, and apply them skilfully in determining the relations of things, is one of the principal distinctions among men, and that which gives some so remarkable a superiority over others, that we are apt to look upon them as creatures of another species.

Thus far we have traced the progress of the mind in thinking, and seen it rising, by natural and easy steps, from its first and simple perfections, to the exercise of its highest and most distinguished faculty. Let us now view

it in another light, as enriched with knowledge, and stored with a variety of discoveries, acquired by the due application of its natural powers. It is obvious to consider it in these circumstances, as taking a general survey of its whole stock of intellectual acquisitions, disposing them under certain heads and classes, and tying them together, according to those connections and dependences it discerns between them. It often happens, in carrying on our inquiries from subject to subject, that we stumble upon unexpected truth, and are encountered by discoveries which our present train of thinking gave no prospect of bringing in our way. A man of clear apprehension, and distinct reason, who, after due search and examination, has mastered any part of knowledge, and even made important discoveries in it, beyond what he at first expected, will not suffer his thoughts to lie jumbled together in the same confused manner as chance offered them; he will be for combining them into a regular system, where their mutual dependence may be easily traced, and the parts seem to grow one out of another. This is that operation of the mind, known by the name of *disposition* or *method*, and comes the last in order, according to the division of the logicians, presupposing some tolerable measure of knowledge, before it can have an opportunity of exerting itself in any extensive degree.

We see, then, that this fourfold distinction of the powers of the mind, into *perception*, *judgment*, *reasoning*, and *disposition*, as well as the order in which they are placed, have a real foundation in nature, and arises from the method and procedure of our own thoughts. It is true, there are many other actions and modifications of the understanding, besides those above-mentioned, as believing, doubting, assenting, &c. but these are all implied in the act of reasoning, in the like manner as compounding, abstracting, remembering, may be referred to the first operation of the mind or perception.

Having thus given a general idea of the four operations of the mind, and traced their connection and dependence one upon another, we would next observe, that in consequence of this division of the powers of the understanding, Logic is divided into four parts, which treat severally of these acts, and give rules and directions for their due conduct and regulation. The operations themselves we have

from nature; but how to exert them justly, and employ them with advantage in the search of truth, is a knowledge that may be acquired by study and observation.— It is certain that we meet with false reasonings as well as just. Some men are distinguished by an accuracy of thinking, and a happy talent of unravelling and throwing light upon the most obscure and intricate subjects. Others confound the easiest speculations; their understandings seem to be formed awry, and they are incapable of either conceiving clearly themselves, or making their thoughts intelligible to others. If, then, we set ourselves carefully to observe what it is that makes the one succeed so well, and how the others come to miscarry, these remarks will furnish us with an art of the highest use and excellency in the conduct of life. Now this is the precise business of Logic, to explain the nature of the human mind, and the proper manner of conducting its several powers, in order to the attainment of truth and knowledge. It lays open those errors and mistakes we are apt through inattention to run into, and teaches us how to distinguish between truth, and what carries only the appearance of it. By this means we grow acquainted with the nature and force of the understanding, see what things lie within its reach, where we may attain certainty and demonstration, and when we must be contented with bare probability. These considerations sufficiently evince the usefulness and benefit of this science, which ought to be established as the foundation and ground work of all our other knowledge, if we really wish to succeed in our inquiries. But we shall now proceed to treat of its parts separately, according to the division given of them above.

1. *Of Simple Apprehension, or Perception.*

THE first thing we observe, when we take a view of what passes within us, is, that we are capable of receiving impressions from a variety of objects, that distinct notices are thereby conveyed into the understanding, and that we are conscious of their being there. This attention of the mind to the objects acting upon it is what we call *simple apprehension*, and is in fact the mind itself taking a view of things as represented to it by its own consciousness. It is by this means that we come to be fur

nished with all those *ideas* about which our thoughts are employed. For, being sensible of the impressions made upon us, and attending to the perceptions they bring, we can renew them again upon occasion, even when the objects that first produced them are removed. Now our *ideas* are nothing else but these renewed representations of what we have at any time perceived and felt; by means of which, things are again brought under the view of the mind, and seem to have a kind of existence in it. It is true, we can upon many occasions combine our ideas variously together, and thereby form to ourselves representations of things that never had an existence in nature, as when we fancy a centaur, or a golden mountain; but it is still certain, that the original ideas out of which things are made, are such as have been conveyed into the mind by some former impressions. It remains therefore to inquire, how we came by our first notions and perceptions of things. Whence does the understanding derive those original impressions and characters, which it can combine in so many different ways, and represent to itself under such infinite varieties? To this I answer, that if we attend carefully to what passes in our own minds, we shall observe two inlets of knowledge, from whence, as from two fountains, the understanding is supplied with all the materials of thinking.

First, outward objects, acting upon our senses, rouse in us a variety of perceptions, according to the different manner in which they affect us. It is thus that we come by the ideas of light and darkness, heat and cold, sweet and bitter, and all those other impressions which we term sensible qualities. This great source and inlet of knowledge is commonly distinguished by the name of *sensation*, as comprehending all the notices conveyed into the mind by impulses made upon the organ of sense.

But these ideas, numerous as they are, are wholly derived to us from without; there is, therefore, another source of impressions, arising from the mind's attention to its own acts, when, turning inwards upon itself, it takes a view of the perceptions that are lodged there, and the various ways in which it employs itself about them. For the ideas furnished by the senses, give the mind an opportunity of exerting its several powers; and as all our thoughts, under whatever form they appear, are attended with consciousness, hence the impressions they leave,

when we come to turn the eye of the soul upon them, enrich the understanding with a new set of perceptions, no less distinct than those conveyed in by the senses. Thus it is that we get ideas of thinking, doubting, believing, willing, &c. which are the different acts and workings of our minds, represented to us by our own consciousness.—This second source of ideas is called *reflection*, and evidently presupposes sensation, as the impressions it furnishes are only of the various powers of the understanding, employed about perceptions already in the mind.

These considerations, if we duly attend to them, will give us a clear and distinct view of the natural procedure of the human intellect in its advances to knowledge. We can have no perception of the operations of our own minds until they are exerted; nor can they be exerted before the understanding is furnished with ideas about which to employ them; and as these ideas, that give the first employment to our faculties, are evidently the perceptions of sense, it is plain that all our knowledge must begin here. This, then, is the first capacity of the human mind, that it is fitted to receive the impressions made upon it by outward objects affecting the senses; which impressions, thus derived into the understanding, and *there lodged* for the view of the soul, employ it in various acts of perceiving, remembering, considering, &c. all which are attended with an internal feeling and consciousness. And this leads us to the second step the mind takes in its progress towards knowledge, viz. that it can by its own consciousness represent to itself these its several workings and operations, and thereby furnish the understanding with a new stock of ideas. From these simple beginnings all our discoveries take their rise; for the mind, thus provided with its original characters and notices of things, has a power of combining, modifying, and examining them in an infinite variety of lights, by which means it is enabled to enlarge the objects of its perception, and finds itself possessed of an inexhaustible stock of materials. It is in the various comparison of these ideas, according to such combinations of them as seem best to suit its ends, that the understanding exerts itself in the acts of judging and reasoning, by which the capacious mind of man pushes on its views of things, adds discovery to discovery, and often extends its thoughts beyond the utmost bounds of the universe.

Thus we see, as it were, at one glance, the whole progress of the soul, from the very first dawnings of perception, till it reaches the perfection of human knowledge; nor shall we, among all its vast stock of discoveries, or that infinite variety of conceptions whereof they consist, be able to find one original idea which is not derived from sensation or reflection, or one complex idea which is not made up of those original ones.

The ideas with which the mind is thus furnished, fall naturally under two heads. First, those original impressions which are conveyed by sensation and reflection, and which exist uniformly and without any shadow of variety, and are called *simple ideas;* such as the ideas of *colour, sound, heat,* &c. And, secondly, those notions which result from the various combinations of simple ideas, whether they are supposed to co-exist in any particular subject, or are united together by the mind when it enlarges its conceptions. These are called *complex ideas;* such as a *triangle,* a *square,* &c.; and are of two kinds: first, such as are derived from external objects, and represent those combinations of thought which have a real existence in nature; of this kind are all our ideas of substances. Secondly, the conceptions formed by the mind itself, arbitrarily uniting and putting together its ideas. This makes by far the largest class, and includes all those ideas which may be properly termed our own. They are called *abstract;* such as *whiteness, beauty, melody,* &c.; and are produced in various ways; for either the mind combines several simple ideas together, in order to form them into one conception, in which the number and quality of the ideas united are principally considered, and thus we acquire all our compound notions; or it fixes upon any of our ideas, whether simple or compound; or upon the ideas of substances, and omitting the circumstances of time, place, real existence, or whatever renders it particular, considers the appearance alone, and makes that a representation of all that are of the same kind; or, lastly, it compares things with one another, examines their mutual connexions, and thereby furnishes itself with a new stock of notions, known by the name of *Relations,* which are either proportional, as *equal, more, less,* or natural, as *father, mother,* &c. or civil, as *king and people, general and army,* &c. This division of our ideas, as it

seems to be the most natural, and truly to represent the manner in which they are introduced into the mind, will be found to include them in all their varieties.

We know that our thoughts, although so numerous, are all contained within our own breasts, and are invisible But as the Supreme Being formed mankind for a state o society, he has provided us with organs proper for fram ing articulate sounds, and has given us also a capacity o using those sounds as signs of all the thoughts we wish to communicate. From hence are derived words and languages. For any sound being once determined upon to stand as the sign of any idea, custom by degrees establishes such a connexion between them, that the appearance of the idea in the mind always brings to our remembrance the name by which it is expressed; and, in like manner, the hearing of the name never fails to excite the idea which it is intended to denote.

"The ends of language are," says Locke, "first to make known one man's thoughts to another; secondly, to do it with ease and quickness; and, thirdly, thereby to convey the knowledge of things. When language fails in any of these requisites, it is abused, or deficient."

In order to show, then, our own knowledge of a subject, to remove ignorance, or prevent mistakes in the minds of those with whom we converse, it is necessary to be able to explain our meaning with precision and accuracy of language. Logic, which teaches the nature and rules of definition, will enable us to do this. Definition puts an end to that ambiguity which is frequently apt to bewilder the understanding, and to produce disputes.

A definition is a sentence *which explains the meaning of a complex idea, by expressing, in proper words, the simple ideas of which it is composed.* Its rules are, that it should be precisely adequate to the term defined; that the words employed in the definition should be clearer and better known than the term defined; and that it should be comprehended in terms which are proper, that is, solely applicable to the term defined. If these rules be observed, the definition may always be put in the place of the term defined, which is the true test of its correctness.

If we were unable to communicate our complex ideas to each other by means of definitions or descriptions, more or less exact, it would in many cases be impossible to make them known. This will appear the more evident in those ideas which are solely the offspring of the mind; for as they have no real objects in nature, according to which they are framed, if we could not convey them to others by description, they must be confined to the limits of a single mind. All the abstract ideas which spring from the fancy of a poet, and which he describes as real persons existing and engaged in action, could not extend their influence beyond his own breast, or give pleasure to any one but himself, if he were destitute of this faculty of displaying them by words.

To simple ideas we shall find definition inapplicable; because, as several terms of a definition signify several ideas, they cannot, when taken altogether, represent one idea which has no composition at all: but as they are intended to make known the meaning of words standing for all complex ideas, if we were always careful to form those ideas, and to copy our definitions from them with exactness, as a skilful painter does a good likeness, much of the obscurity and confusion of language, as it is used both in writing and conversation, might be prevented.

II. *Judgment.*

The mind being furnished with ideas, the next step necessary in the progress of knowledge is to compare them together, in order to judge of their agreement or disagreement. In this connected view of our ideas, if the relation be such as to be immediately discoverable by the bare inspection of the mind, the judgments thence obtained are called *intuitive*, from a word that denotes to look at, or into; for in this case a mere attention to the ideas compared is sufficient to inform us how far they are connected or disjointed. Thus, "that the whole is greater than any of its parts," is an intuitive judgment nothing more being required to convince us of its truth than an attention to the ideas of whole and part. Intui

tion, therefore, is no more than an immediate perception of the agreement or disagreement of any two ideas. This is the first of the three foundations of our knowledge, upon which depends that species of reasoning, which is called demonstration; for whatever is deduced from our intuitive perceptions by a clear and connected series of proofs, is said to be demonstrated, and produces absolute certainty. Hence the knowledge obtained in this manner is what we properly term *science;* because, at every step of the argument, it carries its own evidence with it, and leaves no room for doubt. Demonstration is confined to mathematical studies, and they are indebted to it for their peculiar clearness and certainty.

The second ground of human judgment, from which we infer the existence of the objects which surround us, and fall under the immediate notice of our senses, is *experience.* When we behold the sun, or direct our eyes to a building, we not only have ideas of those objects, but ascribe to them a real existence independent of the mind. It is likewise by the information of the senses, that we judge of the qualities of bodies; as when we assert that snow is white, fire is hot, or steel hard. As intuition is the foundation of all scientific, so is experience the foundation of all natural knowledge; for the latter being wholly conversant with objects of sense, or with those bodies which constitute the natural world, and we can only discover their properties by a series of observations, it is evident, that, in order to improve this branch of knowledge, we must have recourse to the method of trial and experiment.

The third ground of judgment is *testimony.* There are many facts that will not admit an appeal to the senses. All human actions, when considered as already past, are of this description. As from the other two grounds are deduced scientific and natural knowledge, so from this we derive *historical;* by which is meant, not only a knowledge of the civil transactions of states and kingdoms, but of all cases where the evidences of witnesses is the ground of our belief.

The act of assembling our ideas together, and joining or disuniting them according to the result of our perceptions, is called *judgment;* but when these judgments are expressed by words, they are called *propositions.* A *proposition,* therefore, is a sentence denoting some judgment,

whereby two or more ideas are affirmed to agree or disagree. The idea of which we affirm or deny any thing, and of course the term expressing the idea, is called the *subject* of the proposition. The idea affirmed or denied, as also the term expressing it, is called the *predicate*. and that word which, in a proposition, connects these two ideas, is called the *copula*; and if a negative particle be annexed, we thereby understand that the ideas are disjoined. The substantive verb is commonly employed as the copula, as in this proposition: "God *is* omnipotent;" where the verb substantive represents the copula, and signifies the agreement of the ideas of God and omnipotence. But if it be our intention to separate two ideas, then, in addition to the verb substantive, we must also apply some particle of negation, to express this repugnance. The proposition, "man is not perfect," may serve as an example of this kind; where the notion of perfection being removed from the idea of man, the negative particle *not* is inserted after the copula, to signify the disagreement between the subject and the predicate.

Propositions are *affirmative* or *negative*, *universal* or *particular*, *absolute* or *conditional*, *simple* or *compound*; and are generally divisible into *self-evident*, or *demonstrable*.

When the mind admits an agreement between two ideas, we call the admission an *affirmative judgment*; as, on the contrary, a *negative judgment* is the admission of disagreement between the ideas compared: and as any two ideas compared together must necessarily either agree or disagree, it is evident that all our judgments are included in these two divisions. Hence, likewise, the propositions expressing these judgments are all either affirmative or negative. An affirmative proposition connects the predicate with the subject, as "a stone is heavy;" a negative proposition separates them, as "God is not the author of evil." Affirmation, therefore, is the same as joining two ideas together; and this is done by means of the copula. Negation, on the contrary, denotes a repugnance between the ideas compared; in which case, a negative particle must be employed, to show that the connexion included in the copula does not take place.

Our ideas, according to what has been already observed, are all single as they enter the mind, and represent individual objects. But as, by abstraction, we can rea-

der them *universal*, so as to comprehend a whole class of things, and sometimes several classes at once, the terms expressing these ideas must be in like manner universal. Thus when we say, "men are mortal," we consider mortality not as confined to one, or any number of particular men, but as what may be affirmed without exception of the whole species. By this means the proposition becomes as general as the idea which is its subject; and, indeed, derives its universality entirely from that idea being more or less so, according as it may be extended to a smaller or greater number of individuals.

A particular proposition has some general term for its subject, but with a mark of limitation added, to denote that the predicate agrees only with some of the individuals comprehended under a species, or with one or more of the species belonging to a genus, and not with the whole universal idea. Thus, "some stones are heavier than iron." In this proposition, the subject, "some stones," implies only a certain number of individuals comprehended under a single species.

We may observe, therefore, that all propositions are either affirmative or negative; nor is it less evident, that in both cases they may be universal or particular. Hence arises the division of them into *universal affirmative*, and *universal negative*; *particular affirmative*, and *particular negative*.

Propositions are either *absolute* or *conditional*. The absolute are those wherein we affirm some property inseparable from the idea of the subject, and which therefore belongs to it in all possible cases; as, "God is infinitely wise,"—"Virtue tends to the ultimate happiness of man." But when the predicate is not necessarily connected with the idea of the subject, unless upon some consideration distinct from that idea, then the proposition is called conditional. The reason of the name is taken from the supposition annexed, and may be expressed as such: "*If* a stone be exposed to the rays of the sun, it will contract some degree of heat."

A due attention to this division of propositions is very necessary in the pursuit of accurate knowledge. If we be careful never to affirm things absolutely, but when the ideas are inseparably united; and if in our other judgments we distinctly mark the conditions, which determine the predicate to belong to the subject, we shall be less

liable to mistake in applying general truths to the particular concerns of human life.

Propositions, when only two ideas are compared together, are in general called *simple;* because, having but one subject and no predicate, they are the effect of a single judgment, which admits of no subdivision. But if several ideas present themselves to our thoughts at once, so that we are led to affirm the same thing of different objects, or different things of the same object, the propositions expressing these judgments are called *compound;* because they may be resolved into as many others, as there are subjects or predicates in the whole complex determination of the mind. Thus, "God is infinitely wise and infinitely powerful." Here there are two predicates, "infinite wisdom" and "infinite power," both affirmed of the same subject: and accordingly the proposition may be resolved into two others, which distinctly affirm these predicates.

When any proposition is presented to the mind, if the terms in which it is expressed be understood upon comparing the ideas together, the agreement or disagreement asserted is either immediately perceived, or found to be too remote from the present reach of the understanding. In the first case, the proposition is said to be *self-evident,* and requires no proof whatever; because a bare attention to the ideas themselves produces full conviction and certainty. But if the connexion or repugnance be not so readily perceived, we must have recourse to reasoning; and if by a series of proofs we can ascertain the truth proposed, so that self-evidence shall accompany every step of the argument, we are then able to prove our assertion, and the proposition is said to be *demonstrable.* When we affirm, for instance, "that it is impossible for the same thing to be and not to be," whoever understands the terms used, perceives at the first glance the truth of what is asserted, nor can he bring himself to believe the contrary. But if we say, "this world had a beginning," the assertion is indeed equally true, but shines not forth with the same degree of evidence. We find great difficulty in conceiving how the world could be created out of nothing, and are not brought to a full assent of the assertion, until by reasoning we arrive at a clear view of the absurdity involved in the contrary supposition. Hence this proposition is of the kind we call

demonstrable, as its truth is not immediately perceived, but yet may be made evident by means of others more known and obvious, from whence it follows as a necessary consequence.

III. *Reasoning.*

It frequently happens, in comparing our ideas together, that their agreement or disagreement cannot be discerned at first sight, especially if they are of such a nature as not to admit of an exact application to each other. It therefore becomes necessary to discover some third idea, which will admit of such an application as the present case requires; wherein if we succeed, the relation we are in search of may be traced with ease. This manner of determining the relation between any two ideas by the intervention of a third, with which they may be compared, is what we call *reasoning*, and is indeed the chief instrument by which we extend our discoveries, and enlarge our knowledge. The great art consists in finding out such intermediate ideas, as, when compared with the others in question, will furnish evident truths; because it is only by such means we can arrive at the knowledge of what is concealed and remote.

From the limited nature of the human mind arises the necessity of reasoning. When we cannot judge of the truth or falsehood of a proposition by the mere consideration of its subject and predicate, we are obliged to compare each of them with some third idea; that is, by seeing how far they agree or disagree with each other: as for example, if there be two lines, A and B, and we are ignorant whether they are equal or not, we must take a third line, C, and apply it to each of them; if it agree with them both, then we infer that A and B are equal; but if it agree with one and not with the other, then we conclude A and B are unequal; if it agree with neither of them, there can be no comparison. So if the question be whether "God must be worshipped," we seek a third idea; suppose the idea of a Creator; and say, *our Creator must be worshipped; God is our Creator; therefore God must be worshipped.* The comparison of this third idea with the two distinct parts of the question requires two propositions, which are called the *premises*; the third proposition drawn from them is the *conclusion*, in which

the question itself is answered, and the subject and predicate are joined either in the negative or the affirmative.

The foundation of all affirmative conclusions is laid in this general truth, that so far as two ideas agree with any third idea, they agree among themselves. The character of Creator agrees with God, and worship agrees with a Creator; therefore worship agrees with God. The foundation of all negative conclusions is this, that where one of the two proposed ideas agrees with the third idea, and the other disagrees with it, they must disagree so far with one another; as if, for example—No sinners are happy; and if angels are happy, then angels are not sinners. Thus appears the strict notion of a syllogism. *It is a sentence consisting of three propositions so disposed, that the last is necessarily inferred from those which precede it.*

In the constitution of a syllogism, two things are to be considered: its matter and its form. The matter consists of three propositions; and these consist of three ideas, or terms, variously joined. These three terms are named the *major*, the *minor*, and the *middle*. The predicate of the conclusion is called the major term, because it is generally of a more extensive signification than the minor term or subject. The major and minor terms are called the *extremes*. The middle term is the third idea placed in two of the propositions in such a manner as to shew the connexion between the major and the minor terms in the conclusion; for which reason this middle term is sometimes called the *argument*.

The act of reasoning, or inferring one thing from another, is generally expressed by the word *therefore*, when the argument is formed according to the rules of art; though in common conversation or writing, such words as *for*, *because*, point out the act of reasoning, as well as *then* and *therefore*. And wherever these are used, a perfect syllogism is employed, though the three propositions may not be drawn out according to the regular form. These observations are chiefly applicable to simple or categorical syllogisms, although every syllogism contains something analogous to them.

Of all the parts of logic, that which relates to the structure of syllogisms least deserves the attention of a student. Syllogistic reasoning is a display of truth, not a discovery of it. It only shews that the conclusion is contained in

the premises. Every syllogism is no more than a particular application of this general principle,—that what is affirmed or denied of a whole genus, may be affirmed or denied of every species or individual contained in it.

If the forms of syllogism were necessary for the discovery of truth, what did the world do, before the days of Aristotle, without them? Destitute of this aid, Moses delivered to the children of Israel a divine law, and Socrates taught clear and sound morality to the Athenians.

IV. *Method.*

The fourth operation of the mind relates to the arrangement of our thoughts, when we endeavour to unite them in such a manner, that their mutual connection and dependence may be clearly seen. This is *method.* It requires a proper distribution of all the parts of a subject, and that every thing of the same kind should be placed in its proper situation. The great principle of order was first displayed when the Almighty, from the rude materials of chaos, called the world into existence, and regularity was diffused through all parts of nature; and it is conspicuous in all the best productions of man in art, science, and literature. Method is not less an advantage than an ornament to whatever subject it is applied.

In the disposition of our thoughts, either for our own use alone, or when we intend to communicate them to others, there are two modes of proceeding, which are equally in our power to choose.

When a whole subject is divided into several parts, and we proceed regularly from generals to particulars, the method pursued is called the *analytic;* when, on the contrary, these parts are united together according to their mutual connection and affinity, so that the truths first in order contribute to the establishment of those which follow, this makes what is called *synthetic method.* Adopting this process, we proceed by collecting the scattered parts of knowledge, and combining them into one system, in such a manner that the understanding is enabled to follow truth, without error or confusion, through all her different stages.

These two kinds of method admit of easy illustrations. In learning grammar, for instance, we first acquire the

knowledge of letters; we combine them to make syllables; of syllables are composed words, and of words sentences and discourses.

This is synthetic method, and is called the method of *instruction*. We may know superficially what plants are; but it is by the information which the study of botany gives, that we become instructed in the component parts of any one, and distinguish its calix, stamina, corolla, pistillum, species, and genus. We may likewise have a general notion of an animal; but it is by the study of anatomy we gain a particular knowledge of its cartilages, bones, veins, nerves, and all other parts. This is analytic method, and is called the method of *invention*.

This short treatise may be sufficient to prove that logic, beginning with the sources and first principles of thought, ascends regularly from one act of the understanding to another, and connects our ideas in such a manner, that every stage of their progress is clear and satisfactory; that reasoning is the ability of deducing unknown truths from those already known; and that method is necessary for marshalling our ideas, and giving clearness and regularity to them.

CHAP. IV.

OF ELOQUENCE.

ELOQUENCE, in its greatest latitude, denotes "that art or talent by which the discourse is adapted to its end;" so to be truly eloquent is to speak to the purpose.

The most essential requisites in eloquence are, solid argument, clear method, and an appearance of sincerity in the speaker, with such graces of style and utterance as shall invite and command attention. Good sense must be its foundation. Without this, no man can be truly eloquent. Before we can persuade, we must first convince. Convincing and persuading, though sometimes confounded, are of very different import. Conviction affects the understanding only; persuasion, the will and

the practice. It is the business of the philosopher to convince us of truth; it is that of the orator to persuade us to act conformably to it, by engaging our affections in its favour. Conviction is, however, one avenue to the heart; and it is that which an orator must first attempt to gain; for no persuasion can be stable, which is not founded on conviction. But the orator must not be satisfied with convincing; he must address himself to the passions; he must paint to the fancy, and touch the heart; and hence, beside solid argument and clear method, all the captivating and interesting arts, both of composition and pronunciation, enter into the idea of eloquence.

Eloquence may be considered as consisting of three kinds, or degrees. The first, and most inferior, is that which endeavours only to please the hearers. Such, in general, is the eloquence of panegyrics, inaugural orations, addresses to great men, and other harangues of this kind. This ornamental sort of composition may innocently amuse and entertain the mind, and may be connected, at the same time, with very useful sentiments. But it must be acknowledged, that where the speaker intends only to shine and to please, there is no small danger of art being strained into ostentation, and of the composition becoming tiresome and insipid.

A second, and a superior degree of eloquence is, when the speaker proposes, not merely to please, but likewise to inform, to instruct, to convince; when his art is employed in removing prejudices against himself and his cause; in selecting the most proper arguments, stating them with the greatest force, disposing of them in the best order, expressing and delivering them with propriety and beauty, and thereby preparing us to pass that judgment, or favour that side of the cause, to which he desires to bring us. Within this degree, chiefly, is employed the eloquence of the bar.

Yet there remains a third, and still higher degree of eloquence, by which we are not only convinced, but are interested, agitated, and carried along with the speaker; our passions arise with his; we share all his emotions, we love, we hate, we resent, as he inspires us; and are prepared to resolve, or to act, with vigour and warmth. Debate, in popular assemblies, opens the most extensive field for the exercise of this species of eloquence; and the pulpit likewise admits it.

It is necessary to remark, that this high species of eloquence is always the offspring of passion. By passion, we mean that state of mind in which it is agitated and fired by some object it has in view. Hence the universally acknowledged power of enthusiasm in public speakers, affecting their audience. Hence all studied declamation, and laboured ornaments of style, which show the mind to be cool and unmoved, are so incompatible with persuasive eloquence. Hence, every kind of affectation in gesture and pronunciation, diminish so much the merits of a speaker. Hence, in fine, the necessity of being, and of being believed to be disinterested and in earnest, in order to persuade.

The foundation of every species of eloquence, is good sense and solid thought. To speak well, says Cicero, is to speak *justly, methodically, floridly, and copiously*.

Now, in order to speak *justly*, or pertinently, a person must be master of his subject, that he may be able to say all that is proper, and avoid whatever may appear foreign and trifling. And he must clothe his thoughts with such words and expressions as are most suited to the nature of the argument, and will give it the greatest force and evidence.

And as it teaches to speak justly, so likewise *methodically*. This requires that all the parts of a discourse be placed in their proper order, and with such just connection, as to reflect a light upon each other, and thereby to render the whole both clear in itself, and easy to be retained.

To speak *floridly*, requires all the *beauties* and *flowers* of language—the *best* sense and the *clearest* reasoning; in short, it comprehends the whole subject of *elocution*.

But nothing appears of more force in oratory than a *copiousness* of expression, or a proper manner of enlargement, suited to the nature of the subject; which is of great use in persuasion, and forms the last part of speaking well.

To ascertain the leading principles relating to eloquence in general, it may be sufficient to consider the subject under five distinct heads.

I. The sources of argument.
II. The different kinds of style.
III. The ornaments of a composition.

IV. The arrangement of the different parts of a composition.

V. Propriety of delivery and action.

I. *The Sources of Argument.*

The basis of all eloquence is *invention*. This faculty, strictly speaking, relates to discovery rather than creation, and must be understood to signify new associations of those ideas which had been previously stored in the mind. It is this which enables the speaker to form such topics as are necessary for the statement, explanation, and illustration of his subject, with a view to conciliate the minds of his hearers, and engage them in his favour. A liveliness of imagination, and a quickness of thought, are great assistances to invention; and they who possess these gifts of nature, are found to be rarely at a loss for reasons to defend truth and detect error. Of this prime faculty the most eminent orators and poets were in full possession; and we find that so far from giving us any cause to complain of barrenness of invention, they display the abundant produce of intellectual fertility. This remark is particularly justified, among other instances, by the examples of Homer, Plato, and Cicero.

Accurate learning, and extensive knowledge, the prospects of nature, the discoveries of art, the aids of education, and the results of experience and observation upon mankind, are the proper funds to supply this faculty with its requisite stores. Hence are furnished the various topics, whether *external* or *internal*, which are applicable to the different kinds of causes, whether *demonstrative*, *deliberative*, or *judicial*, and which are treated of at large by the rhetoricians, and particularly by Aristotle and Cicero. The judgment must ever be active in the right application of the assistance, which genius and extensive knowledge can bring to every particular subject; whatever is trifling and superfluous must be rejected; and nothing admitted into a composition that is not fully to the purpose, and calculated to answer the end originally proposed.

II. *The different Kinds of Style.*

Style is the manner in which a person expresses himself by means of words, and it is characteristic of his thoughts. It is the description or picture of his mind. As eloquence derives its chief excellence, beauty, and splendour, from style, it is of the greatest importance to the orator to be well acquainted with its various kinds.

Every country possesses, not only a peculiar language, but a peculiar style, suited to the temper and genius of its inhabitants. The eastern nations are remarkable for diction, which is full and sonorous, strong and forcible, and animated by bold and expressive figures. On the contrary, the northern languages are deficient in these respects, and generally partake of the cold influence of their climate. In the former, the warmth of imagination predominates; in the latter, there is more of the strictness and correctness of judgment.

The principal distinctions of style arise from the diversity of subjects. The same mode of expression would be as inconsistent upon different occasions, as the same dress for persons of different ranks, or for different seasons of the year. Propriety, therefore, requires expression to be adapted to the nature of the subject. Style is sometimes divided into three kinds, the *low* or *plain*; the *middle* or *temperate*; and the *lofty* or *sublime*. As, however these three divisions may be found, upon examination, to be too theoretical, it may be better to adopt a more striking and more marked distinction, by separating the stile into the *plain* and the *grand*.

A plain stile is that of which the words are direct and strictly proper; it sinks not to those which are vulgar, nor does it rise to those which are lofty. As it is employed to describe things correctly and clearly, its proper subjects are letters, essays, narratives, works of science, and philosophy, or any other topics that require little or no ornament, or addresses to the passions. Simplicity and ease are its peculiar beauties; and the choicest examples of it are to be found in the works of Xenophon and Cæsar, and the sermons of Secker and Wilson———

——They are
Veil'd in a simple robe, their best attire,
Beyond the pomp of dress——

The *grand* style belongs to those subjects which admit all the splendour, force, and dignity of composition. It is the soil which is favourable to the growth of the fairest flowers of eloquence. Here the most select words, flowing periods, and bright and animated tropes and figures, find their proper place. The dialogues of Plato, the speeches of Livy, and the most admired orations of Demosthenes and Cicero, afford the best examples.

As it is a matter of importance that the style should be adapted to the subject, this care is in no respect more indispensible than in the sublime and the pathetic.

The *sublime* includes the grandest thoughts which the mind is capable of forming. Such thoughts relate either to divine subjects, to the works of nature, or such expressions, or actions, as are esteemed the noblest and the best. The sublime shines by its own native light, and far from soliciting, rejects the assistance of ornament; for, when the mind is elevated to the utmost extent of its powers by a noble idea, it attends not to the niceties of language; but, from its own vigorous and lively conception of things, expresses them in terms the most emphatic, and best adapted to their nature. Dignity and majesty are the proper qualities of this species of style, both as to the thought and expression; as may be best illustrated by numerous passages in the Holy Scriptures, the Iliad of Homer, and the Paradise Lost of Milton.

The sublime often relates to subjects which the mind cannot fully comprehend, and derives part of its effect from obscurity. Thus, in surveying the prospects of nature, we are more struck with a view of such mountains as Snowden, or Benlomond, when their summits are envelop-ed in clouds, than when they are completely visible. A cataract partly concealed by trees, and which is more heard than seen, produces the same effect. Lightning and thunder increase their terror from happening when the sky is black with clouds, or during the night.

No passages are more sublime than some in scripture, which combine the terrific with the obscure. Such is the description given in the Psalms, of the manifestation of the Almighty *There went a smoke out in his presence; and a*

consuming fire out of his mouth, so that coals were kindled at it. He bowed the heavens also, and came down: and it was dark under his feet. He rode upon the cherubims, and did fly; he came flying upon the wings of the wind. He made darkness his secret place, his pavilion round about him with dark water, and thick clouds to cover him. And again—*The waters saw thee, O God, the waters saw thee, and were afraid: the depths also were troubled. The clouds poured out water, the air thundered; and thine arrows went abroad. The voice of thy thunder was heard round about; the lightning shone upon the ground: the earth was moved and shook withal. Thy way is in the sea, and thy paths in the great waters, and thy footsteps are not known.*

The noblest example is recorded by Moses in the Book of Genesis, when he describes the Almighty commencing his work of creation. *And God said let there be light—and there was light.* Every other instance, whether ancient or modern, whether taken from an historian, orator, poet, or philosopher, sinks infinitely below this. So that with good reason did Longinus, who had all the works of antiquity before him, pronounce his high approbation of this passage.

With the sublime is properly classed the *pathetic* of composition, wherein the greatest power is exerted over the passions. Here we are interested, agitated, and carried along with the speaker or writer, wherever he chooses to lead us; our passions are made to rise in unison with his; we love, detest, admire, resent, as he inspires us; and are prompted to feel with fervour, and to act with energy, in obedience to the particular impulse which he gives to our minds. Quintilian, with great propriety, calls this power of moving the passions, the soul and spirit of his art: as the proper use of the passions is not to blind or to counteract the exercise of reason, but to move in conformity to it; if an improper impulse be sometimes given to them, it is not the fault of the art, but of the artist. The pulpit admits this species of eloquence, as is clear from the sermons of Masillon and Bourdaloue; but the fictitious scenes of tragedy open the most extensive field for its display.

The diction of an orator may include various kinds of style. As he speaks sometimes to prove and instruct, sometimes to entertain and delight, and sometimes to rouse,

animate, and astonish, he must be occasionally plain, manly, figurative, pathetic, or sublime. All this variety, however, is rarely necessary upon the same occasion. Due regard must be paid to the nature of the subject, the dispositions of the audience, the time, the place, and all other circumstances.

III. *The Ornaments of a Composition.*

THE most ancient languages, such as the Hebrew and the Arabic, are highly figurative; and so are those which are spoken by the wild tribes of Indians and Americans. "We have planted the tree of peace," said an American orator, "and we have buried the axe under its roots; we will henceforth repose under its shade; and we will join to brighten the chain which binds our nations together." Such figurative expressions as these, which in an unimproved state of language arise from necessity, were, in process of time, used in more polished societies, for the sake of decoration, like garments originally used for protection against inclement weather, were afterwards worn for the sake of ornament. The imagination, and the passions, have an extensive influence over every language; the thoughts and emotions they suggest are expressed by words taken from sensible objects, and the names of these objects were the words first introduced into all languages, and by degrees applied to other thoughts more abstract and obscure, to which it was difficult to assign distinct and proper words.

The ornaments of composition are divided into *tropes* and *figures*. Tropes and figures are distinguished from each other in several respects; but tropes mostly affect single words, whilst figures have relation to whole sentences.

Tropes and figures promote strength of expression and brevity; and brevity, united with perspicuity, is always agreeable. Tropes and figures are often used to supply the unavoidable defects of language, and are favourable to delicacy. When the proper name of any thing is in any respect unpleasant, a well chosen trope will convey the idea in such a way as to give no offence to the most delicate ear.

Tropes and figures are the dress of sentiment; and consequently should be adapted to the character of that style

they are intended to embellish; their uses are very extensive—as large as universal nature; for there are scarce any two things which have not some similitude between them; and as almost every sentence is more or less figurative, therefore they require to be judiciously applied.

In general, *tropes* and *figures* of speech convey two ideas to the mind, by a departure from simplicity of expression, and the change of a word from its proper signification to some other, with advantage, either as to beauty or strength: for instance, when an artful man is called a *fox*, the reason of the name is founded on a similitude of qualities; if we say *Milton* will always *live*, meaning his *works*, the cause is transferred to the effect; to say, "The sun rises," is a common expression, but it becomes a magnificent image when expressed with *dignity*, as Thomson has done:

> "But yonder comes the pow'rful king of day
> "Rejoicing in the east."

By a figure of speech being justly applied, even conviction is assisted, and truth is impressed on the mind with additional force.

Having considered the nature of tropes and figures, in the next place we shall mention such of them as are of the greatest importance; viz. *metaphor, allegory, simile, metonymy, personification, apostrophe, antithesis, interrogation, exclamation*, and *climax*.

A *metaphor* is usually defined, a trope, which changes words from their proper signification to another different from it, by reason of some similitude or resemblance which one object bears to another, and is nearly allied to simile or comparison. It is a similitude when we say a *man* has acted like a *lion*; and a metaphor when we say he is a *lion*. Metaphors are forms of expression very frequent in the sacred writings; as, "Thy word is a lamp to my feet, and a light to my path." The use of metaphors is very extensive; and may be applied to any two things, which have the least similitude between them.

Metaphors may be taken from a similitude between animate beings; as, a man may be compared to a brute, and asked *why he barked so*? or, *why he bellowed so?* From a similitude of inanimate things, whether natural or artificial; as *clouds of smoke*, and *pillars of fire*, for large quantities;

and from inanimate things being compared to the actions and other attributes of animals; thus Cicero, speaking of Clodius, says, "The very altars, when they saw that monster fall, seemed to move themselves, and assert their right against him. Here the words *saw*, *move*, and *assert*, are metaphors taken from the properties of animals.

As to the choice of metaphors, those are esteemed the finest and strongest, which *give life and action to inanimate things*: the reason of which is, because they do as it were invigorate all nature, introduce new forms of beings, and represent their images to the sight, which, of all the senses, is the quickest, most active, and yet the most unwearied.

Metaphors, which are by far the most fruitful of all figures, should on no occasion be too bold and glaring, neither too profuse; nor should they sink below the dignity of what they are designed to answer, but should always be such as are agreeable to the strain of our sentiments.

Allegory may be considered a continued metaphor, or a continuation of several tropes in one or more sentences. Thus Cicero says; "Fortune provided you no field, in which your virtue could run and display itself;" the words *field* and *run* are metaphors taken from corporeal things, and applied to the mind.

Allegory was a favourite method of delivering instruction in ancient times: for what we call parables or fables, are no other than allegories. By words and actions attributed to beasts, or inanimate objects, the dispositions of men were figured; and what we call the moral, is the unfigured sense, or meaning of the allegory.

Simile or *comparison*, illustrates a thing by comparing it with some other, to which it bears a resemblance; as when it is said, "The actions of princes are like those great rivers, the course of which every one beholds, but their springs have been seen by few." Similes are generally but weak arguments, though often beautiful and fine ornaments; they are not so much designed to prove what is doubtful, as to set things in a clear and agreeable light; and the more exact the agreement is between the things compared, the greater beauty and grace is given to the figure.

Metonymy, is the putting one word for another, and is founded on the several relations of cause and effect.—When we say, "We have read Milton," the cause is put

instead of the effect; meaning "Milton's works." On the other hand, when it is said, "Gray hairs are honourable," we put the effect for the cause, meaning by "gray hairs," *old age*.

Personification, or *the fiction of a person*, by which life, action, or speech is attributed to some inanimate object; as, when we say, "The ground *thirsts* for rain," or "The earth *smiles* with plenty;" "The heavens *declare* the glory of God, and the firmament *sheweth* his handy works."

Apostrophe or *address*, is a turning off from a regular discourse, and addressing some particular person *present*, or *absent*, living, or dead, or to inanimate nature, has something very sublime and solemn in it, which we often meet with in sacred writ; as, "Hear, O heavens, and give ear, O earth! for the Lord hath spoken."

Antithesis or *opposition*, arises from two objects being set in contrast; and moral maxims naturally assume this form, as, "If you wish to enrich a person, study not to increase his store, but to diminish his desires." "If you regulate your desires according to the standard of nature, you will never be poor; if according to the standard of opinion, you will never be rich."

Interrogation, in its literal sense, is merely asking a question; but it becomes figurative when the same thing may be expressed in a direct manner; and the putting it by way of question gives it much greater life and spirit.—Thus Balaam expressed himself to Balak: "The Lord is not man that he should lie, neither the son of man that he should repent. Hath he said it? and shall he not do it? Hath he spoken it? and shall he not make it good?"

Exclamations are the effect of strong emotions of the mind, naturally venting themselves by this figure; such as joy, grief, surprise, admiration, &c. as in Pope's dying Christian to his soul:

"Lend, lend your wings! I mount! I fly!
"O grave! where is thy victory?
"O death! where is thy sting?

Climax is a beautiful kind of repetition, when the word which ends the first member of a period, begins the second, and so through each member, till the whole is finished.—There is a great deal of strength, as well as beauty, in this figure, where the several steps rise naturally, and are

closely connected with each other. As in this example: "There is no enjoyment of property without government, no government without a magistrate, no magistrate without obedience, and no obedience where every one acts as he pleases."

IV. *The Arrangement of the different Parts of a Composition.*

It is necessary that all parts of a speech be placed in their proper order, and united in such a manner, as to render the whole clear in itself, and easy to be understood. A regular arrangement of parts is of the greatest advantage to the speaker, as it assists his memory, and carries him through his discourse without tautology or confusion. He ought never to forget that perspicuity of *order* is as necessary as perspicuity of *language.*

Cicero divided an oration into six parts, namely, the *introduction, narration, proposition, confirmation, confutation,* and *conclusion:* and this is the arrangement usually adopted in systems of rhetoric. The simplest division, however, is that recommended by Aristotle in his Rhetoric, consisting only of the *introduction,* the *statement of the subject,* its *proofs,* and the *conclusion.*

There are many excellent speeches, however, where several of these parts are wanting, where the speaker uses no introduction, as is the case in the first Oration against Cataline, but begins abruptly. There are others, which he finds it unnecessary to divide into parts, but enters at once into his subject, and is borne along by the rapid tide of argument, till he reaches his conclusion. As, however, these have always been considered as the constituent parts of a speech, and as in every one some of them must necessarily be found, they properly obtain a place in all systems of rhetoric.

In addition to the parts which compose a regular oration, already laid down, there are three other measures remaining, to which orators have recourse; viz. *digression, transition,* and *amplification.*

Digression, as defined by Quintilian is, "A going of from the subject we are upon, to some different thing which may be of service to it."

Transition is often used, not only after a digression, but likewise upon other occasions: it is, "A form of speech, by which the speaker in a few words tells his hearers what he has said already."

Amplification is not barely a method of enlarging upon a thing, but so to represent in the fullest and most comprehensive view, as that it may in the liveliest manner strike the mind, and influence the passions.

V. *Propriety of delivery and Action.*

In the delivery ot a speech, great judgment is necessary; and there is no part of eloquence which stands more in need of instructions. The orator must be careful to avoid the extremes of awkwardness and affectation; he must not be inanimate on the one hand, or theatrical on the other. To well regulated tones, emphasis, and pauses, must be united propriety of delivery and action. It is justly remarked by Cicero, that every thought and emotion of the soul have their peculiar expression of voice, features, and gestures; and the whole body, every variation of the face, and tone of the voice, like the strings of a musical instrument, act agreeably to the impulse they receive from the mind. The correspondence of passions and emotions with expression, as is shewn in real life, must be attentively observed, and to follow some good living example will be highly advantageous. More fully to stimulate his exertions, let him advert to the effects which have been produced by excellence in this branch of his art. Was it not the impassioned delivery of Demosthenes, to which his rival Æschines has left such a remarkable and such an honourable testimony, that gave resistless persuasion to his speeches? Was it not the indignant countenance, the animated tone, and the judicious action of Cicero, which communicated such commanding influence, and powerful weight to his arguments, when he confounded the audacious Cataline? And was it not the dignified air, and the persuasive mildness of Masillon, which added to his religious instruction so much force, when he drew from Louis XIV. a confession of the power of sacred eloquence?

He who aspires to the character of a good public speaker, must make judgment the rule of his conduct; for no at-

tainments can secure reputation without it. Nothing ought to be carried to an extreme; the flights of imagination must be restrained by discretion, and propriety must give laws to every effort. Thus will he take the surest road to excellence; he will be bold, not rash; serious, but not severe; gay, not licentious; copious, without redundance, and sublime, without extravagance or bombast.

"Follow *nature*, is certainly the fundamental law of oratory; she instructs us to relate a story, to support an argument, to command a servant, to utter exclamations of anger or rage, to pour forth lamentations and sorrows, not only with different tones, but different elevations of voice:" thus we observe the various ways by which nature expresses the several emotions and passions of the human mind; and every one will acknowledge it to be of some consequence, *that what a man has occasion to do every hour in the day, ought to be done well.*

In the next place, we shall enumerate some of those parts of elocution which render speaking and reading intelligible and graceful. These may be comprehended under the following heads; viz. *pauses, accent, emphasis, cadence, tone of voice,* and *gesture.*

Pauses are rests in speaking or reading, to mark the distinctions of sense; during which, the speaker is enabled to draw dreath without inconvenience, and thereby preserve the command of his voice; without which the sense must always appear confused and obscure, and often be misunderstood.

A continued quick utterance, where no other pauses are made, than those necessary for taking breath, is one of the worst faults a speaker or reader can have.

The next thing to be regarded in reading is the *emphasis;* and to see that it be always laid on the emphatical word.

When we distinguish any particular syllable in a word with a strong voice, it is called *accent;* when we thus distinguish any particular word in a sentence, it is called *emphasis;* and the word so distinguished the *emphatical word.* And the emphatical words (for there are often more than one) in a sentence are those which carry a weight or importance in themselves, or those on which the sense of the rest depends; and these must always be distinguished

by a fuller and stronger sound of voice, wherever they are found, whether in the beginning, middle, or end of a sentence.

> Get pláce and weálth, if possible, with gráce;
> If not, by ány means, get weálth and pláce.—POPE.

In these lines the emphatical words are accented; and which they are, the sense will always discover.

Here it may not be amiss to observe two or three things.

1. That some sentences are so full and comprehensive, that almost every word is emphatical: For instance, that pathetic expostulation in the prophecy of Ezekiel,

Why will ye die?

In this short sentence every word is emphatical; and on whichever word you lay the emphasis, whether the first, second, third, or fourth, it strikes out a different sense, and opens a new subject of moving expostulation.

Some sentences are equivocal, as well as some words; that is, contain in them more senses than one; and which is the sense intended, can only be known by observing on what word the emphasis is laid. For instance—*Shall you ride to town to-day?* This question is capable of being taken in four different senses, according to the different words on which you lay the emphasis. If it be laid on the word *you*, the answer may be, *No, but I intend to send my servant in my stead.* If the emphasis be laid on the word *ride*, the proper answer might be, *No, I intend to walk it.* If you place the emphasis on the word *town*, it is a different question; and the answer may be, *No, for I design to ride into the country.* And if the emphasis be laid on the word *to-day*, the sense is still something different from all these; and the proper answer may be, *No, but I shall to-morrow.* Of such importance sometimes is a right emphasis, in order to determine the proper sense of what we read or speak. But I would observe,

The voice must express, as near as may be, the very sense or idea designed to be conveyed by the emphatical word, by a strong, rough, and violent, or a soft, smooth, and tender sound.

Thus the different passions of the mind are to be expressed by a different sound or tone of voice. *Love*, by a soft, smooth, languishing voice; *Anger*, by a strong, vehement, and elevated voice; *Joy*, by a quick, sweet, and clear voice; *Sorrow*, by a slow, flexible, interrupted voice; *Fear*, by a dejected, tremulous, hesitating voice; *Courage* hath a full, bold, and loud voice; and *Perplexity*, a grave, steady, and earnest one. Briefly, in *Exordiums* the voice should be low; in *Narrations*, distinct; in *Reasoning*, slow; in *Persuasion*, strong: it should thunder in *Anger*, soften in *Sorrow*, tremble in *Fear*, and melt in *Love*.

The variation of the emphasis must not only distinguish the various passions described, but the several forms and figures of speech in which they are expressed; e. g.

In a *Prosopopœia*, we must change the voice as the person introduced would.

In an *Antithesis*, one contrary must be pronounced louder than the other.

In a *Climax*, the voice should always rise with it.

In *Dialogues*, it should alter with the parts.

In *Repetitions*, it should be loudest in the second place.

Words of quality and distinction, or of praise or dispraise, must be pronounced with a strong emphasis.

Hence, then, it follows,

Lastly, That no emphasis at all is better than a wrong or misplaced one; for *that* only perplexes, *this* always misleads, the mind of the hearer.

The next thing to be observed is *Cadence*.

This is directly opposite to *Emphasis*. *Emphasis* is raising the voice; *Cadence* is falling it; and, when rightly managed, is very musical.

But besides a cadence of voice, there is such a thing as cadence of style; and that is, when the sense being almost expressed and perfectly discerned by the reader, the remaining words (which are only necessary to complete the period) gently fall of themselves without any emphatical word among them. And if your author's language be pure and elegant, his cadence of style will naturally direct your cadence of voice.

Cadence generally takes place at the end of a sentence, unless it closes with an emphatical word.

Every *Parenthesis* is to be pronounced in cadence; that is, with a low voice, and quicker than ordinary; that it may not take off the attention too much from the sense of the period it interrupts. But all *Apostrophes* and *Prosopopœias* are to be pronounced in *Emphasis*.

The tones and heights of the voice at the close of a sentence ought to be infinitely diversified, according to the nature of the discourse, and meaning of the sentence.

In plain narrative, and especially in argumentation, the least attention to the manner in which we relate a story, or support an argument in conversation, will shew, that it is more frequently proper to raise the voice, than to fall it at the end of a sentence. Interrogatives, where the speaker seems to expect an answer, should almost always be elevated at the close, with a peculiar tone, to indicate that a question is asked. Some sentences are so constructed, that the last word requires a stronger emphasis than any of the preceding; whilst others admit of being closed with a soft and gentle sound.

When there is nothing in the sense which requires the last sound to be elevated or emphatical, an easy fall, sufficient to shew that the sense is finished, will be proper: and in pathetic pieces, especially those of the plaintive, tender, or solemn kind, the tone of the passion will often require a still lower cadence of the voice. But before a speaker can be able to fall his voice with propriety and judgment at the close of a sentence, he must be able to keep it from falling, and to raise it with all the variations which the sense requires. The best method of correcting an uniform cadence, is often to read *select sentences*, in which the style is pointed, and frequent *antitheses* are introduced; and argumentative pieces, or such as abound with interrogatives.

Tone of voice teaches us to speak or read so loud as to be heard by those about us, but never higher than the occasion requires; for the extremes of vociferation, to use Shakespeare's phrase, "offend the judicious hearer by tearing a passion into rags:" therefore let caution be used against every extreme. The music of speech consists in the variations of the voice; but these variations must be gradual to render them pleasant, being united with a graceful and expressive delivery. Let the sound be an "echo to the sense;" humour your voice a little

according to the nature of the subject, but, in *plain narration*, there is no occasion for much variety of tones; the *pauses*, the *accent*, the *emphasis*, the *cadence*, are the only things that herein require to be observed. The fundamental rule to be observed in reading, is, to let the tone of your voice be the same as in speaking: do not affect to change that natural and easy sound wherewith you speak, for a strange, new, aukward tone; but attend to your subject, and deliver it just in the same manner as you would do if you were talking of it. *This important rule*, if carefully observed, will correct almost all the faults of a bad pronunciation.

Gesture may be defined to be the motions of the countenance, and several other parts of the body in speaking and reading.

When any passion is raised within us, we discover it by the manner in which we utter our words, by the features of the face, and other well-known signs; for nature herself has assigned to every motion of the soul its peculiar cast of the countenance, and manner of gesture. And as nature has taught us to express the passions we feel, by certain motions of the body and countenance, we therefore should guard against aukward and disagreeable ones; and endeavour to acquire such as are easy and becoming, keeping the body in a natural, easy, graceful attitude, thereby uniting the expression of action to the propriety of pronunciation, in order to give the sentiment its full impression on the mind. But where no particular emotion is expressed, a serious, firm, and manly look, is always to be preferred. When we attempt to express any passion, we should copy nature, and endeavour to feel what imagination is capable of raising in the mind: for, as Cicero observed, "Every motion of the mind has naturally its peculiar countenance, voice, and gesture; and, like the strings of an instrument, act agreeably to the impressions they receive from the mind."

As to the several parts of the body, the head is the most considerable; to lift it up too high has the air of arrogance and pride; to stretch it out too far, or throw it back, looks clownish and unmannerly; to hang it downwards on the breast shews an unmannerly bashfulness and want of spirit; and to suffer it to lean on either shoulder

argues both sloth and indolence. It ought to be kept in its natural upright posture, with easy and gentle movement, as occasion may require, that the voice may be heard by all that are present, and then easily return again to its natural position.

Nothing is more unbecoming than the violent motions and agitations of the head. Butler ridicules a pretender to knowledge in the following words:—

> " For having three times shook his head
> " To stir his wit up, thus he said."
>
> HUDIBRAS.

But the eyes are the most active; and all the passions of the soul are expressed in them, in a manner which cannot possibly be represented by any gesture of the body.

In speaking upon pleasant and delightful subjects, the eyes are brisk and cheerful; and, on the contrary, they are languid and faint, in delivering any thing melancholy and sorrowful. This is so agreeable to nature, that, before a person speaks, we are prepared with the expectation of one or the other, from his different aspect.

As to the hands, they have a great variety of motions. With them we *call*, *dismiss*, *threaten*, *beseech*, *deny*, &c. which seem to be, in all nations and countries, the common symbolical language of mankind.

CHAP. V.

THE PASSIONS.

VARIOUS theories have been published, by which their authors have endeavoured to elucidate the manner in which the passions are excited in and act upon the soul, the agitation of which is expressed in many different modes by the features and muscles. Indeed, the language of this ethereal and inexplicable spirit speaks through every fibre, and each passion is known to an indifferent spectator, without the intervention of an explanatory sound.

It would seem, from the sudden and involuntary experience of agitation, that the passions were implanted in the soul as centinels watchful for its safety, and that of the person it inhabits. Were this the truth, as some have observed, it might be supposed, that every impulse would be found correct and proper: sad conviction, however, proves, it is added, that nothing can be more ill-founded than such a supposition, as not an individual exists at this moment who has not discovered, that he has feared where he ought to have esteemed, hated when he ought to have admired, loved when he ought to have detested, and in numerous instances been blinded either by misconceived partiality, or equally unjust prejudice. Such, at least, is the decision of unthinking persons; those, on the contrary, who do justice to the Creator, feel and acknowledge, that the passions are the most correct of centinels, particularly when guided and governed by the superior gift of reason.

Origin of the Passions and Affections.

Some of the *affections*, besides what are called the natural appetites, are commonly believed to be instinctive, and therefore take the name of *natural*. Such are the parental, filial, and fraternal affections: also, the love of truth and virtue. Other affections are evidently *factitious;* such as avarice, friendship, patriotism.

The *phenomena* which countenance the supposition that certain affections are implanted by nature in the human mind, are these: the apparent simplicity, and likewise the strength and vividness of these feelings, together with the difficulty and supposed impossibility of tracing them to any other cause: also, the assumed universality and general uniformity of such affections in the human species.

It is, however, a presumption against this supposition of a double origin of the affections, that feelings so similar in their nature and effects should be so unlike in their origin. The general rule of philosophising is, that phenomena of the same kind are to be traced up to the same cause. *Association* is the acknowledged cause of some of the affections, therefore probably of all.

The affections are states of considerable pleasure or pain: they are evidently excited by external objects; but

these, excepting in the case of impressed sensations, can only affect us by association: therefore all the affections are the result of association.

Successive impressions, pleasing or painful, are made upon the mind by the objects of the affection; the *coalescence* of these impressions constitutes the affection either of love or hatred, according to the predominance either of pleasing or painful ideas: the affection thus formed is modified by the circumstances of probable or improbable, past, present, future, and the like; and is associated with the sensation of the object, with the idea, with the name, and with a variety of accidental circumstances.

We love our friends: this affection is compounded of complacency and good-will. We think upon them with complacency, because they possess many virtues, because they have been the immediate cause of many pleasing sensations and recollections, because their idea is associated with many other pleasures than those which they have directly produced; we desire their happiness from a sense of gratitude, from the delight we take in seeing them happy, from the conviction that the greater their happiness is, the greater will be their capacity for communicating happiness to others, &c. These feelings coalesce into a complex and vivid affection: we call it friendship: it associates itself with the persons of our friends, with their idea, with their name, and with many circumstances naturally or fortuitously connected with them.

A child is continually receiving marks of kindness from his father: these produce complacency, and by reciprocal expressions of complacency benevolence is generated. The parent sometimes contradicts the will of the child, sometimes expresses displeasure, sometimes corrects and chastises him. This produces fear. Complacency, benevolence, and fear, combined together, constitute filial reverence and affection. If the parent is wise, and maintains in his conduct a just medium between indulgence and severity, the filial affection generated thereby is of the most perfect kind, and productive of the best effects of filial duty and mutual happiness. If indulgence predominates, the child becomes a prey to ungovernable passions and self-will; and as he advances to maturity, seeing the folly of his parent, and feeling its pernicious effects, filial affection degenerates into contempt. If severity is

the character of the father, fear and aversion will be the inevitable feeling of the child; and the harsh and unkind parent will in vain look for the attentions of a dutiful and affectionate family to sooth the infirmities of declining years.

In a similar way, it would be easy to analyse the conjugal, parental, and fraternal affections, patriotism or the love of one's country, benevolence, the love of truth and virtue, the love of God, &c.; and thus to prove that all the affections of the human mind are the effects of association, and not of instinct.

That the affections are very *complex* feelings, though apparently simple, is evident from the preceding analysis. What the elements are which combine to constitute an affection in any given case, and in what proportion they are blended together, is very difficult, if not impossible, to ascertain.

Impressions which are the elements of filial and fraternal affection, and of the love of truth and virtue, and the like, are made upon the mind before the memory begins to record its ideas: hence these affections are regarded as having a peculiar claim to the character of *natural*. The universality of parental affection seems to have gained it the character of *instinctive*. But the transfer of the mutual affection of the parents to their infant offspring seems sufficient to account for the origin of the affection; while the helplessness of the infant, the hopes of the parent, and a multitude of other circumstances which it is unnecessary, and would indeed be tedious, to enumerate, easily explain the growth of parental affection.

Classifications of the Passions and Affections.

Affections are modifications of pleasure and pain, arising from the perception of natural good or evil, according to the circumstances in which they occur to the notice of the mind.

They are sometimes called *passions*, as opposed to actions; the latter being perfectly voluntary, the former not being immediately dependent on the will.

Dr. Cogan makes a curious, and, perhaps, a just distinction between passion, emotion, and affection. *Passion* is the first feeling of which the mind is conscious,

from some impulsive cause by which it is wholly acted upon, without any efforts of its own, either to solicit or to escape the impression. *Emotions* are the sensible effects produced by the impetus of the passion upon the corporeal system. *Affections* signify the less violent, more deliberate, and more permanent impressions, whether pleasing or painful, whether of a benevolent or malevolent character.

The *primary*, or general passions, according to Dr. Hartley's distribution of them, are ten: five grateful. and five ungrateful.

Of the five grateful passions, the first is *love*, which arises from the contemplation of good in the abstract.—2. *Desire*, which is love excited so as to put us upon action.—3. *Hope*, which arises from the probability of attaining absent good. 4. *Joy*, from the possession of the present good.—And, 5, *Pleasing recollection*, which takes place when the object is withdrawn, and keeps up love to it.

The five ungrateful primary passions corresponding with the five grateful ones, and excited by the perception of evil in similar circumstances, are *hatred*, *aversion*, that is, active hatred, *fear*, *grief*, and *displeasing recollection*.

The affections are arranged by Dr. Hartley, under six general classes, viz. *imagination*, *ambition*, *self-interest*, *sympathy*, *theopathy*, and the *moral sense*.

First, the pleasures and pains of *imagination*: these arise from the perception of natural or artificial beauty or deformity, and are distinguished into seven kinds:—1. Those pleasures which arise from the beauty of the natural world.—2. From the works of art.—3. From the liberal arts of music, painting, and poetry.—4. From the sciences.—5. From beauty of person.—6. From wit and humour.—7. The pains which arise from gross absurdity, inconsistency, or deformity.

Secondly, the pleasures and pains of *ambition*, which arise from the opinions of others concerning us; the sense of honour and of shame. These respect, 1. *External advantages* or *disadvantages*; the principal of these are fine clothes, riches, titles, and high birth; with their opposites, rags, poverty, obscurity, and low birth.—2. *Bodily perfections* and *imperfections*; these are beauty, strength, and health; or deformity, imbecility, and disease.—3. *Intellectual accomplishments* and *defects*: these are sagacity, memory, invention, wit, learning; and their opposites, fol-

ly, dulness, and ignorance.—4. *Virtue and vice*; namely, piety, benevolence, courage, temperance, chastity, humility; and the vices contrary to these.

Thirdly, The pleasures and pains of *self interest*; arising from the possession or want of the means of happiness; and security from, or subjection to, the hazards of misery. Self-interest is of three kinds.—1. *Gross self interest*, or the cool pursuit of the means whereby the pleasures of sensation, imagination, and ambition, are to be attained, and their pains avoided: of this the chief species is the love of money.—2. *Refined self-interest*, or the deliberate pursuit of the means that relate to the pleasures and pains of sympathy, theopathy, and the moral sense; when religion, virtue, and benevolence, are practised with an explicit view to our own happiness.—3. *Rational self interest*, or the pursuit of the greatest possible happiness, without any possible partiality to this or that kind of happiness, means of happiness, &c. This is the same thing with the abstract desire of happiness and aversion to misery, which is not, however, a universal affection, though commonly believed to be such. The hopes and fears relating to a future state, or to death, are of this kind.

Fourthly, the pleasures and pains of *sympathy*, that is, those which arise from the pleasures and pains of our fellow creatures. Of these there are four classes:

1. Those by which we *rejoice at the happiness of others*; these are sociality, benevolence, generosity, gratitude.—*Sociality* is the pleasure we take in the company and conversation of others, and particularly of our friends and acquaintance, and is attended with affability, complaisance, and candour. In children it is generated by the preponderance of pleasure which they receive from, or in company with, others, and the same cause generally operates to produce the same effect through life. *Benevolence* is that pleasing affection which engages us to promote the welfare of others to the best of our power. It rises from sources similar to sociality, and it is cherished by the high degree of esteem annexed to it, and the advantages it procures. *Generosity* is an an affection which disposes us to forego great pleasures, or to endure great pains, for the benefit of others: it is benevolence in a high degree.—*Gratitude* is benevolence exercised towards a benefactor.

2. Those by which we *grieve for the misery of others*; these are compassion and mercy. *Compassion* is the unea-

siness which a man feels at the misery of another. It is generated in children by those expressions of pain in others which excite similar feelings in themselves; by the pains taken to excite the sympathy of children when parents, attendants, and others, are suffering; by the restraints they often undergo from the uneasinesses and pains of others: and in adults, it is confirmed by irritability of nerves, by great similar trials and afflictions, by benevolence to suffering friends, by the esteem and praise annexed to it, and the like. *Mercy* is compassion exercised to an object that has forfeited his title to the continuance of happiness, or to the removal of misery, by some demerit, particularly against ourselves.

3. Those by which we *rejoice at the misery of others*; these are moroseness, anger, revenge, jealousy, cruelty, and malice. *Moroseness*, peevishness, and severity, arise from whatever makes disagreeable impressions upon the mind, while our fellow-creatures, or their ideas, are present with us. *Anger* is a sudden start of passion, by which men wish and endeavour harm to others. *Revenge* rejoices in it when done. Anger is generated by the desire to prevent harm to ourselves, which leads us to threaten it to others, to desire their harm, and so to inflict it; but in proportion as a correct moral sense gains its due influence over us, anger is restricted to voluntary agents who intentionally injure us, and proportioned to the degree of injury received. *Malice* deliberately wishes the misery of others. *Cruelty* delights in the view and infliction of it, without the consideration of injury received. These are habits of mind. They originate in anger indulged and gratified, and are most apt to rise in the minds of the proud, the selfish, and the timorous. *Jealousy* arises from the suspicion of a rival in the affections of a person of the other sex. It is a species of anger.

4. Those affections by which we *grieve for the happiness of others*, are *emulation* and *envy*. These arise from the eager desire of riches, honour, power, &c. which leads us to think, that our happiness is diminished by what others enjoy.

5. The pleasures and pains of *theopathy*, or those which arise from the contemplation of God, of his attributes, and of our relation to him. These are love and fear. *Love* is associated with gratitude, confidence, and resignation. It is produced by the contemplation of divine bounty and be-

mignity; and it is supported and increased by the consciousness of upright intentions, the hope of future reward, by prayer, conversation, and contemplation. The love of God rises in part from interested motives; but when all the sources of it coalesce, it becomes as disinterested as any other affection, and may rise to such a height as to prevail over all other desires, interested or disinterested. *Enthusiasm* is a mistaken persuasion of any person that he is a peculiar favourite with God, and that he receives supernatural marks thereof. It is a degeneration of love. The *fear* of God arises from a view of the evils of life, the threatenings of scripture, the sense of guilt, the infinity of the divine attributes, from prayer, meditation, and the like. When restrained within proper limits, it is awe and reverence; when excessive, or not duly regarded, it degenerates into superstition, or atheism. *Superstition* is a mistaken opinion concerning the severity and punishments of God, magnifying these in respect of ourselves or others. *Atheism* is speculative or practical. Speculative atheism denies the existence of God. Practical atheism is the neglect of God; thinking of him seldom and with reluctance; disregarding him in actions, though not denying him in words. Both kinds may be supposed often to proceed from a sense of guilt, and consequent fear of God, producing aversion to him.

6. The pleasures and pains of the *moral sense*, excited by the contemplation of moral beauty and deformity.—The *moral sense* is the disinterested approbation of piety, benevolence, and self government in ourselves and others, and the correspondent disapprobation of vice. It is the result of education and mental discipline; it leads to the pure love of God and the practice of universal virtue.—*Scrupulosity* is a degeneration of the moral sense, which arises from a consciousness of guilt, and an erroneous method of reasoning.

CHAP. VI.

NATURAL AND EXPERIMENTAL PHILOSOPHY.

NATURAL philosophy is commonly defined to be that art or science which considers the powers and properties of natural bodies, and their mutual actions on each other. *Moral philosophy* relates to whatever concerns the *mind* and *intellect; natural philosophy* on the other hand, is only concerned with the *material* part of the creation. The *Moralist's* business is to enquire into the nature of virtue, the causes and effects of vice, to propose remedies for it, and to point out the mode of attaining happiness. The *Naturalist*, on the contrary, has nothing to do with spirit; his business is confined to body or matter. The business of natural philosophy, then, is to collect the history of the phenomena which take place amongst natural things, viz. amongst the bodies of the universe; to investigate their causes and effects; and thence to deduce such natural laws, as may afterwards be applied to a variety of useful purposes.

Natural things means all bodies; and the assemblage or system of them all is called the *universe*.

The word *phenomenon* signifies an appearance, or in a more enlarged acceptation, whatever is perceived by our senses. Thus the fall of a stone, the evaporation of water, the solution of salt in water, a flash of lightning, and so on; all are phenomena.

As all phenomena depend on *properties* peculiar to different bodies; for it is the property of a stone to fall towards the earth, of the water to evaporate, of the salt to be soluble in water, &c. therefore we say that the business of natural philosophy is to examine the properties of the various bodies of the universe, to investigate their causes, and thence to infer useful deductions.

By *natural causes* are to be understood the means by which things come at first to have their being or existence. thus God is the cause of all created beings, because from him they received their being; and hence God is called by way of pre-eminence the *first* or *primary cause* of all things.

Secondary causes are those which produce their effects

according to the established and original laws and rules, implanted in their natures at their first creation by God, the *primary cause*; of all other causes he is the original cause; and consequently they, with regard to the *first cause*, can be only properly termed *secondary causes*: as the sun causeth vapours; and vapours cause clouds; and clouds condensed cause rain; rain causeth springs; rivers, vegetation, &c. but yet they all act in a secondary manner, under the original influence of the first cause as aforesaid.

An *effect* is whatever is produced or brought to pass by the action or operation of any natural cause: thus vapours are the effect of the sun's attraction; ice is the effect of a cold air; visibility the effect of light, &c. &c.

The application and uses of natural philosophy, or the advantages which mankind may derive therefrom will be easily suggested by a very superficial examination of whatever takes place about us. The properties of the air we breathe; the action and power of our limbs; the light, the sound, and other perceptions of our senses; the actions of the engines that are used in husbandry, navigation, &c.; the vicissitudes of the seasons, the movements of the celestial bodies, and so forth; do all fall under the consideration of the philosopher. Our welfare, our very existence, depends upon them.

The axioms of philosophy, or the axioms which have been deduced from common and constant experience, are so evident and so generally known, that it will be sufficient to mention a few of them only.

1. Nothing has no property; hence, 2. No substance, or nothings can be produced from nothing. 3. Matter cannot be annihilated, or reduced to nothing. 4. Every effect has, or is produced by, a cause, and is proportionate to it.

It may in general be observed, with respect to those axioms, that we only mean to assert what has been constantly shewn, and confirmed by experience, and is not contradicted either by reason, or by any experiment. But we do not mean to assert that they are as evident as the axioms of geometry; nor do we in the least presume to prescribe limits to the agency of the Almighty Creator of every thing, whose power and whose ends are too far removed from the reach of our understandings.

Having stated the principal axioms of philosophy, it is ne-

the next place necessary to mention the rules of philosophizing, which have been formed after mature consideration, for the purpose of preventing errors as much as possible, and in order to lead the student of nature along the shortest and safest way, to the attainment of true and useful knowledge.

Those rules are not more than four, viz. 1. We are to admit no more causes of natural things, than such as are both true and sufficient to explain the appearances.—2. Therefore, to the same natural effects we must, as far as possible, assign the same causes.—3. Such qualities of bodies as are not capable of increase or decrease, and which are found to belong to all bodies within the reach of our experiments, are to be esteemed the universal qualities of all bodies whatsoever.—4. In experimental philosophy we are to look upon propositions collected by general induction from phenomena, as accurately or very nearly true, notwithstanding any contrary hypothesis that may be imagined, till such time as other phenomena occur, by which they either may be corrected, or may be shewn to be liable to exceptions.

With respect to the degree of evidence which ought to be expected in natural philosophy, it is necessary to remark, that physical matters cannot be in general capable of such absolute certainty as the branches of mathematics. The propositions of the latter science are clearly deduced from a set of axioms so very simple and evident, as to convey perfect conviction to the mind; nor can any of them be denied without a manifest absurdity. But, in natural philosophy, we can only say, that because some particular effects have been constantly produced under certain circumstances; therefore they will most likely continue to be produced as long as the same circumstances exist; and likewise that they do, in all probability, depend upon those circumstances. Providence acts by determinate laws in all the arrangements of nature. It is not by chance, nor yet by an arbitrary disposal of things, that the operations of nature are affected. By the Divine wisdom all things are disposed in weight and in measure; they are ordered on certain principles, and effected in certain constant and regular modes.

These modes, in which the Divine wisdom acts and governs the material universe, are termed the *laws of nature*. We cannot, it is true, account for every thing; we cannot

trace effects to their remotest causes; but yet much is known by the long observation, and the discoveries of learned and ingenious men from time to time. They have therefore reduced what they call the laws of nature, that is, the manner in which the operations of nature are affected, to a few principles, and these principles, when well understood, will apply to the explanation of a long series of *phenomena*.

It is by *experiment* that all the great discoveries of the moderns have been accomplished. This, indeed, forms the grand line of distinction between the ancient and modern philosophy, and this constitutes the sole merit and superiority of the latter. The ancients reasoned and conjectured about things; the moderns have submitted every thing to the direct and positive test of experience; this philosophy has therefore been termed *experimental philosophy*, because all its doctrines and principles are founded upon actual experiment, in opposition to that philosophy which is founded on fancy and conjecture.

Of Elements, or the First Principles of Bodies.

To philosophize, is to observe minutely, and with attention; to be not satisfied with a superficial view of the appearances of things, but to examine into their causes. One of the first enquiries that strikes a reflecting mind, is, "What are all the different objects I see about me made of? What is this hard substance of which rocks and stones are composed? What is water? What is air?" A word has been invented to express the substance of every thing that is an object of our senses; that is, *matter;* and *matter* and *material* things are used in opposition to *spirit*, or *spiritual* things, which are not objects either of our sight or hearing: thus the human body is *matter*, but the soul is a *spirit*. We are not, however, hastily to conclude that all this matter, which enters into the composition of things, is originally or radically the same; such an idea was once entertained by some of the old philosophers, but we have no experiments to warrant such a conclusion.

To find out, if possible, the different kinds of matter which enter into the composition of bodies, recourse has been had to what is called *chemical analysis;* that is, the different bodies or substances have been dissolved by the

aid of heat and moisture, into their different parts, and these parts have been separated, and again examined.—Wonderful discoveries have resulted from these experiments. The hardest and most solid bodies have been changed into air or vapour; for instance, the diamond itself. Hard and solid stones have been found to consist partly of lime, partly of iron, and partly of some other earth. Water has been decomposed, and found to consist of two aeriform fluids: and these have again been united, by another process, into their origiual state of water.

The original principles or particles of bodies have been called *elements*, which is derived from a Greek word, signifying to *create*. Elements are, therefore, those principles or particles of which bodies are *created* or formed. The ancients supposed only four elements, from which they imagined all the different bodies in the universe were formed. These were fire, air, earth, and water. But since modern philosophy has analysed or divided different bodies or substances into their constituent parts, we have been obliged to adopt a different arrangement; and, instead of one kind of earth, we find at least there are four or five kinds, essentially different from each other, besides that metals and salts are not earth. The air we breathe we find to be a compound of two different fluids, as well as water.

When chemical analysis has been pushed to its utmost extent, and bodies have been subdivided as minutely as possible, we are warranted in calling those principles, which we cannot further analyse or separate, elementary principles. They are the minutest particles of matter we are capable of observing; and whether they are in fact susceptible of further subdivision or not, whether they are simple or compound, it is satisfactory to know that we have discovered a few substances from which all other bodies are compounded or derived.

The substances which philosophers have hitherto been unable to decompound, and which therefore, in the present state of science, we are justified in terming elementary, are the following:

1st. Fire. Including light and the electric fluid.

2d. Oxygen. This, in the aeriform state, has been called pure, vital, or dephlogisticated air. It gives the acid character to saline or vegetable bodies when united with them; and, when united with metals, gives them the calci-

form an cinder-like appearance, when the metallic lustre is destroyed; such is their state in the ore.

3d. Hydrogen. This, in the aeriform state, is called inflammable air; and being lighter than the common air, has been used to inflate air balloons. United with oxygen, it forms pure water.

4th. Azote, which, in the aeriform state has been called phlogisticated or impure air. It forms about three fourths of our common air, and is that part of it which is left after animals have breathed in a glass or receiver of air, or after a candle has ceased to burn in it. Condensed into a fluid, with a certain portion of oxygen, it becomes nitrous acid or aqua fortis.

5th. Phosphorus. A substance well known, and which, united with oxygen, produces phosphoric acid.

6th. Coal. Charcoal is the purest state in which this substance is found; our common pit coal being usually united with other matter. In the aeriform state, coal becomes what is called fixed air, or choak damp. It is, in fact, the principal material in the composition of all vegetable substances.

7th. Sulphur, which combined with oxygen, forms vitriolic acid, oil or spirit of vitriol.

8th. Muriatic salt, or the radical matter of common salt. In the state of common salt it is united not only with a certain portion of oxygen, but with an alkali. When simply united with oxygen, it is called the acid of sea salt, muriatic acid, spirit of sea salt, &c.

9th. Fluor, or the radical matter of the beautiful fluor spar.

10th. Borax, or the radical matter of the salt used by braziers, tinmen, &c. for soldering, and known by that name.

11th. The alkalies. The name alkali was derived from one of these substances called the mineral alkali, being produced from the ashes of a marine plant called kali; it is also found in the earth in a mineral state in some parts of the world. The other, the vegetable alkali, is commonly known by the name of potash, and is obtained from the ashes of any vegetable matter.

12th. Earths, which are at least of five different kinds.

13th. Metals, which are about seventeen in number.

These we see, in the present state of philosophical know-

ledge, authorised in considering as simple or elementary substances. They are usually found in a state of combination; the first six chiefly enter into the composition of animal and vegetable bodies, the latter abound most in the mineral world.

1st. *Fire.* That this is a fluid of a peculiar kind can no longer be doubted, since it has all the properties of a fluid. It is perceptible to our senses only in a disengaged or active state; that is, in passing from one body to another: it is, however, diffused very copiously throughout nature. By its elastic nature it is the cause of all fluidity, and indeed, was it not for the influence of this subtile fluid, the whole matter of the universe, there is reason to believe, would be condensed into a solid mass. Thus it is obvious, that by withdrawing a certain portion of its natural heat from water, that fluid becomes a natural body, and is converted into ice. But the general effects of fire, in the economy of nature, are so important, that it will be necessary to treat of them under a distinct head.

2d. *Oxygen.* In the aeriform state this substance is found uncombined with any other matter than that portion of elementary fire which is necessary to keep it in the aeriform state, or in the state of an elastic fluid; for all fluids are such only by agency of fire, which keeps the particles separate, and prevents their settling into a solid mass. In this state it constitutes about one fourth part of the air of our atmosphere, and it is called pure, or vital air, because it is the only part which will support flame, or animal life; for, if a quantity of common air be inclosed in a close vessel, such as a bell glass, or the receiver of an air pump, we will find, as soon as the pure air is consumed, a candle will go out in it, nor can an animal any longer breathe or exist in it.

There is another very extraordinary property of oxygen (from which, indeed, it has derived its present name, *oxus*, signifying, in Greek, sharp or acid,) and that is, that it is the matter which gives the acid character to all other substances, which are susceptible of that property. Thus, if common sulphur or brimstone, which we all know is in itself not acid or sour, is burnt in pure or oxygen air, or in common air, (in which case it imbibes all the pure part of it) it is converted into vitriolic acid. — The same is the process in making vinegar. Beer, wine,

or sugar and water, all which have a strong attraction for oxygen, are exposed to the air, and, by imbibing the pure part of it, or the oxygen, a sour liquor is gradually produced.

The metals, by uniting with oxygen, are deprived of their lustre, and assume the appearance of a calx or cinder; thus iron becomes rusty, that is, in effect, calcined, (for rust is a calx of iron,) by being exposed to air or water, from which it attracts the oxygen. In this state most of the metals are found in the bowels of the earth, and are called ores. From the calces of some of the metals, oxygen air may be obtained, chiefly by the application of heat.

3d. *Hydrogen* has received its name from the Greek *hydor*, water, being the chief constituent of that fluid.—Water is indeed composed of rather more than three parts of oxygen and one of hydrogen. In an aeriform state hydrogen constitutes inflammable air, or gas, and is obtained for the purpose of filling air balloons, &c. by any process which decomposes water. Thus, when water is made to pass through a tube of iron made red hot, such as a gun barrel, the oxygen is absorbed by the iron, which is then calcined, and the hydrogen is disengaged, and comes forth in the form of inflammable air or gas. Hydrogen enters pretty largely into the composition of all animal and vegetable bodies, particularly the former; with coaly water it forms oil, and all the animal and vegetable oils consist of different proportions of charcoal and hydrogen. With azote it constitutes that well known substance, ammoniac, volatile alkali, or spirit of hartshorn.

4th. *Azote*, which derives its name from the Greek particle *a*, signifying *from*, and *zoe*, life, signifying that it takes away life, or, more properly, that it does not sustain it, is one of the most abundant elements in nature. In its aeriform state, when it is called azotic gas by the French philosophers, it constitutes about two thirds of the air we breathe. When oxygenated, or combined with oxygen, it forms nitrous acid, or aqua fortis. It composes no inconsiderable part of animal and vegetable bodies, from which it may be drawn by a chemical process; and the quantity of ammoniac or volatile alkali, which in putrefaction is emitted by these substances, and which is the

chief cause of their fœtid and disagreeable smell in that state, is formed by an union of the hydrogen and azote which they contain.

5th. *Phosphorus* is chiefly obtained from animal substances; it is now procured by a chemical process from bones. It however exists in some mineral bodies. It has so strong an attraction for oxygen, that its spontaneous inflammation and combustion, is entirely owing to this circumstance. All aerial substances are kept in that state by the matter of fire, which is combined with them, and which separates their particles, which float in a kind of fiery atmosphere. When phosphorus, therefore, is exposed to the air, the oxygen, which then exists in the state of pure air, or oxygen gas, is attracted by it, and condensed, and consequently the fire which is combined with it is let loose, and becomes active and obvious to our senses.

6th. *Coal* exists, we observed, in a pure state only in charcoal. It is, in fact, the graet constituent of all vegetable matter, and common pit coal is wood or other vegetables which have been buried in the earth by the general deluge, or by some other great convulsion of nature. It is, however, from these circumstances, necessarily combined with some mineral substances, such as sulphur, which it has got from its situation in the mines from whence it is extracted; charcoal, on the contrary, is the matter as it existed in the substance of the wood or vegetable which contained it, the extraneous matter being driven off by the heat which is employed in preparing it. The whole of a piece of charcoal may be converted into fixed air, called carbonic acid gas by the French philosophers, which prove sufficiently that fixed air is nothing but charcoal united with the oxygen, which is derived from the air.

7th. *Sulphur*, or brimstone, is a well known substance. It chiefly exists in the mineral world, and abounds most in the neighbourhood of volcanos. It is a very combustible substance, because it has a very strong attraction for the oxygen which is contained in the atmosphere, and which being imbibed by the sulphur in combustion, the fire with which it was united in that state is set free. Sulphur unites with the ores of most metals. The crude antimony of the shops, is antimony and sulphur; and that beautiful

substance called pyrites, mundic or Irish diamond, is a combination of sulphur and iron.

8th. *Muriatic* matter, or the radical substance of sea-salt, is not yet known to exist in an uncombined state.— United with oxygen, it forms marine acid, or spirit of salt, which again united with an alkali, forms our common salt.

9th. *Fluor* also is not found in an uncombined state.— It is united with oxygen to form the fluor acid, which again united with lime, constitutes that beautiful substance known by the name of fluor spar, or Derbyshire spar.

10th. *Borax* resembles the two former substances in not being found in a pure and simple state. The borax used in commerce, is a compound salt formed from the boracic acid, which necessarily supposes an union with oxygen and one of the alkalies.

11th. The *alkalies*, called potash and soda, we have spoken of in a preceding part of our work.

12th and 13th. Of the earths and metals we have also treated under a preceding head.

Of Matter, and its Properties.

In general, we may define matter to be, every being that acts upon our senses, either immediately, or by the perceptible effects it produces upon other bodies.

Every species of matter that has hitherto come under our observation, has been found to possess the following characteristics, or properties; and, therefore, we are perhaps justifiable in considering them as belonging to all bodies whatever, viz. *solidity*, or *impenetrability*, *divisibility*, and *mobility*. Some species of bodies have other qualities, which are not common to all, and perhaps matter in general possesses properties which we are yet ignorant of.

We do not here consider *solidity* as opposed to fluidity, but as that property, which every body possesses of not permitting any other substance to occupy the same place with it at the same time. By solidity, or impenetrability, in common language, is understood the property of not being easily separated into parts, and therefore we must be careful not to confound this meaning of the term with the property we have just mentioned.

Divisibility is that property by which matter is capable of being separated into parts which may be removed from each other.

This divisibility is evident in bodies of a sensible magnitude; every one knows that they may be divided into two, four, ten, or a thousand parts; nor can we ever, by subdividing, arrive at a part so small, but we can conceive that it consists of two halves. But how far this actual division can be carried, whether to infinity, as some suppose, or whether we should at last arrive at ultimate atoms, or particles, which, from their nature, are not capable of subdivision, is a point upon which much has been said, but which is not yet determined.

However this may be, the actual division of matter can be carried to an amazing and inconceivable extent. A grain of gold is hammered by the gold-beaters until it is the thirty thousandth part of a line in thickness, and will cover 50 square inches. Each square inch may be divided into 200 strips, and each strip into 200 parts, each of which may be seen by the eye; consequently, a square inch contains 40,000 visible parts, which multiplied by 50, the number of square inches which a grain of gold will make, gives 2,000,000 parts, which may be seen with the naked eye.

A still more striking instance is afforded by the manufacture of gold lace. In making this, they gild a bar of silver, and afterwards draw it out into wire, by passing it successively through holes of various magnitudes, in plates of steel. By this means the surface is prodigiously augmented, notwithstanding which, it remains gilded, so as to preserve an uniform appearance, even when examined by the microscope. It has been calculated, that sixteen ounces of gold, which, if in the form of a cube, would not measure one inch and a quarter in its side, will completely gild a quantity of silver wire, sufficient to circumscribe the whole globe of the earth.

Mobility means that property by which matter is capable of being moved from one part of space to another.

Space is only an abstract idea; and can be described only by its want of properties. Space has no limits or bounds; it consists of parts, which may be divided by the mind, but are not capable of actual separation from each other, and it cannot afford any resistance to bodies moving

through it. Being perfectly uniform in all its parts, it is impossible to distinguish them from each other, but by the bodies placed in them.

Extension has been by some considered as a distinguishing property of matter; but as space is also extended, this cannot be reckoned a characteristic.

Besides these, matter possesses a property, which is called *inertia*, or inactivity; by which it would always continue in whatever state it was put, whether of rest or motion, unless prevented by some external force. That matter can begin to move of itself, after being at rest, no one can suppose; but it does not appear so evident that it has a tendency to continue in motion for ever. Most people are apt to suppose, that all matter has a propensity to fall from a state of motion into a state of rest; because we see all the motions upon the earth gradually decay, and at last totally cease. But this is owing to the resistance of the air, and to friction; for if these are diminished, the body will move longer, and if they could be removed altogether, the body would continue for ever in motion.

If a man be standing in a boat while it is pushed off from the shore, he will be in danger of falling backwards, but he will gradually acquire the motion of the boat; and if it be suddenly stopped, he will fall forwards, because his tendency will then be to continue in the same state of motion. Innumerable instances of the same kind, in common life, may be observed.

Matter also possesses powers of attraction and repulsion, which we shall consider.

Of Attraction

By *attraction* we mean the tendency that bodies have to approach each other. And first, in elucidation of this subject, if you throw a stone, or shoot an arrow into the air, instead of proceeding according to the direction in which you send it, you see its force is quickly spent, and it returns to the earth with a velocity or swiftness proportioned to its bulk or weight. Now, it is easy to conceive, that the resistance of the air may stop it in its progress; but why should it return? Why should not the resistence of the air stop or impede it in its return?

The answer you will think very plain— It is its *weight* that brings it back to the earth, you will say, and it falls because it is a heavy body. But what is weight? Or why is it heavy? It is, in truth, the earth which draws or *attracts* the stone or the arrow towards it; this overcomes the force with which you sent it from you at first, and the resistance which the air would otherwise make to its falling.

To make this plainer, if you drop a little water, or any other liquid, on a table, and place upon the liquid a piece of loaf sugar, you will see the water or fluid ascend, or in vulgar language, be sucked up into the pores of the sugar; that is, the one is attracted by the other. Again, if you take two leaden bullets, and pare a piece off the side of each, and make the surface, where you have taken off the piece, exceedingly smooth, and then press the two balls together, you will find them adhere strongly together, that is, they are mutually attracted by each other.

If you take a piece of sealing-wax, or amber, with a smooth surface, and rub it pretty quickly upon your woollen stocking till it gets warm, you will find that if straws, feathers, hairs, or any very light bodies, are brought within the distance of from an inch to half an inch of it, these light bodies will be drawn to the sealing wax or amber, and will adhere to it. Thus, in philosophical language, they are attracted by it.

This last effect is very similar to what may be observed of the magnet or loadstone, or what is frequently performed by the little artificial magnets, which are commonly sold, and which afford a very rational and pretty amusement to young persons.

But what is a still more surprising effect of attraction, if we take two phial bottles, which we number 1 and 2, fill each of them with a fluid perfectly colourless; we see they appear like clear water: on mixing them together, we will observe the mixture becomes perfectly black. We take another phial, No. 3, which contains also a colourless fluid, and we pour it into this black liquor, which again becomes, we see, perfectly clear, except a little sediment which remains at bottom. Lastly, we take the phial, No. 4, containing also a liquid clear like water, and by adding a little of it, the black colour we see is restored.

All this appears like magic, but it is nothing more than

the effect of attraction. Philosophy keeps no secrets, and we will explain it. The colourless liquor in the phial, No. 1, is water in which bruised galls have been steeped or infused; that in No. 2 is a *solution of copperas*, (called by chemists *sal martis*, salt of steel) in plain terms, it is water in which common copperas, or green vitriol, is dissolved. The iron which this salt (green vitriol) contains, has a strong attraction for the gall water; and when they are mixed together they unite, and the mixture becomes black; in fact, is made into ink. But when the phial, No. 3, which contains aqua fortis (or the nitrous acid, as it is called by chemists), is poured in, the iron, which has a stronger attraction for it than for the galls, unites with it, and having left the galls, the liquid is again clear. Again, the phial No. 4, contains salt of wormwood in a fluid state, which the chemists call an *alkali*. The aqua fortis is nitrous acid, therefore, has a stronger attraction for this alkaline matter than it has for the iron; it therefore drops the iron, which again unites with the matter of the galls, and you see the fluid resume its black complexion.

These several kinds of attractions, which we have now mentioned, philosophers have arranged under five distinct heads. The *first*, that we mean, of the stone or arrow falling to the ground, they have called the attraction *of gravity*, or gravitation. The second, that of the two leaden balls adhering together, and of the water ascending into the pores of the sugar, they call the attraction *of cohesion*, and also capillary attraction. The third is *electrical* attraction, because the sealing wax, when chafed or warmed by rubbing against your stocking, is in an electrified or excited state, like the glass cylinder of an electrical machine when rubbed against the cushion, and therefore attracts the hair, feathers, &c. The fourth is the *magnetic* attraction; and the fifth is called *chemical* attraction, or the attraction of combination, because upon it many of the processes and experiments in chemistry depend; and because by this means most of the combinations which we observe in salts, the ores of metals, and other mineral bodies, are effected.

On the two first of these species of attraction only we shall at present enlarge, because it will be necessary to treat of the others, when we come to investigate those branches of science to which they properly belong.

First, therefore, of gravitation. It requires no experiment to shew the attraction of gravity; for since the earth is in the form of a globe, it is manifest that it must be endued with a power of attraction to keep upon its surface, the various bodies which exist there, without their being hurled away into the immensity of space in the course of its rotary diurnal (or daily) motion. The earth has therefore been compared to a large magnet, which attracts all smaller bodies towards its center. This is the true cause of *weight* or *gravity* (which mean the same thing.) All bodies are drawn towards the earth by the force of its attraction; and this attraction is exerted in proportion to the quantity of solid matter which any body contains. Thus, when two bodies are placed in opposite scales, and we see one preponderate, we say it is heavier than the other; in fact, that it contains a greater quantity of solid matter. For as every particle of matter is attracted by the earth, the greater number of such particles any body contains, the more forcibly it will be attracted. We know, by experience, that the *weight* or *gravity* of a body or thing is not in proportion to its bulk. A bullet of lead, of the same size as one of wood, or of cork, will weigh infinitely heavier, and one of gold would be heavier still. It is reasonable, therefore, to suppose that the ball of gold, or of lead, contains a greater number of solid particles, which are united or pressed closer together than those of the wood or cork, which is more porous, and its particles lie less closely compressed or compacted together. This, then, is what is meant by *specific gravity*, that one body contains more solid particles within a certain compass, size, bulk, or space than another.

It is one of the laws of nature, discovered by Newton, and now received by all philosophers, that every particle of matter gravitates towards every other particle; which law is the main principle in the Newtonian philosophy. The planets and comets all gravitate towards the sun, and towards each other, as well as the sun towards them, and that in proportion to the quantity of matter in each.

All terrestrial bodies tend toward a point, which is either accurately, or very nearly, the centre of the earth; consequently, bodies fall every where perpendicular to its surface, and therefore on opposite sides in opposite directions. As it acts upon all bodies in proportion to their

quantities of matter, it is this attractive force that constitutes the weight of bodies.

The cause of gravity is totally unknown. Many theories have been invented to account for it, but they have been all mere hypotheses or conjectures, without any solid foundation.

II. The *attraction of cohesion* is observable in almost every natural object, since in reality it is that which holds their parts together. It has been already demonstrated, in the experiment of the two leaden balls, and the same effect will be proved by pressing together the smooth surfaces of two pieces of looking-glass, particularly if a little moisture is dropped between them to exclude the air more perfectly. The adhesion or tenacity of all bodies is supposed to depend on the degree of this attraction which exists between their particles; and the cohesive power of several solid substances has been ascertained by a course of experiments, in which it was to put to the test what weight a piece of each body of *one* tenth of an inch diameter would sustain, and the weights were found to be as follow:

Raw flax	37 lbs.	Ash	50 lbs.
Horse hair	45	Zinc	18
Raw Hemp	46	Lead	29¼
Raw silk	53½	Tin	40½
Fir wood	23	Copper	299
Elm	35	Brass	360
Alder	40	Silver	370
Oak	48	Iron	450
Beech	50	Gold	500

This cohesion is also visible even in fluid substances, the particles of which adhere together, though with a less degree of tenacity than solid bodies "The pearly dew" is a well known phrase in poetical language, and the drops of rain, or of dew, upon the leaves of plants, assume this round or pearly appearance by the attraction which the particles have for one another. In the same manner quicksilver, if divided into the smallest grains, will appear round, like small shot, because the particles attract each other equally in every direction, and thus each particle draws others to it on every side, as far as its power extends. For the same reason, two small drops of quik-sil-

ver, when brought near to each other, will seem to run together and unite.

Some bodies, however, in certain circumstances, appear to possess a power the reverse of attraction; and this is called, in philosophical language, *repulsion.*

Of Magnetism.

THERE is scarcely any instance in which the principle of attraction is displayed in a more striking manner than in that of the *magnet* or *load-stone;* so called, as is conjectured, from *load,* the Saxon word for *lead,* that is, the *leading*-stone, from its proving a guide to seamen by means of the compass, or magnetic needle, which always point to the north.

The load-stone, or natural magnet, is an ore of iron; that is, iron united in a state resembling a cinder, or calx, with some other substance. This is, indeed, the state in which most metals are found in the mines, that is, resembling a stone or cinder; and being afterwards purified by the action of fire in the furnace, the other matter with which the metal was united is driven off, and the metal appears in its proper state, and fit for mechanical purposes.

Load-stones are found more or less in every iron mine. They are of a dull brownish black colour, and most of them are sufficiently hard to afford sparks like a flint when struck with steel.

The great and distinguishing property of the magnet, is its *attraction* for iron; and this attraction is mutual between them.

This property, which is possessed by the natural load-stone, it will communicate to any other piece of iron by only touching it; and the piece of iron thus converted into a magnet, will communicate it to others, and these again to other iron, without losing any part of their magnetic virtue, which seems rather increased than diminished by action. Magnets made by being touched by a load-stone, or by other iron which has been touched by it, are called artificial magnets, and are commonly sold in the shops of those who deal in mathematical and philosophical instruments. Soft iron acquires magnetism with more ease than hard iron or steel, but the latter will retain it much longer. A well tempered bar of steel will retain the magnetic virtue for many years without diminution.

Those magnets which communicate most freely, and in the greatest degree the magnetic virtue, are called *generous;* those which raise the greatest weight, in proportion to their size, are called *vigorous* magnets.

The magnetic virtue is found to be the most active at two opposite points of each magnet, which have been termed its poles, from their correspondence with the poles of the earth, as is found by placing the magnet on a small piece of wood floating on water, or in any situation in which it may turn freely, when the magnet will arrange itself exactly in that direction, namely, from north to south.

In England, we call that the south pole of the magnet which points towards the north, and that is termed the north pole which is directed to the south. The foreign philosophers, on the contrary, name them according to the pole to which they point. That is, the north pole of the magnet is that which is directed to the north or arctic region, and the contrary.

The principle of *repulsion* is also very strikingly exemplified by the magnet; for if the same pole of two magnets is presented one to the other, that is, the north pole of one magnet to the north pole of the other, they will mutually repel or drive away each other; if, on the contrary, the south pole of the one is presented to the north pole of the other, they will be mutually attracted. It is on this account that it is necessary, in making artificial magnets, to draw the magnet, with which they are rubbed or touched, always one way. It is most effectually done also by applying one of the poles of the magnet to the bar or piece of iron which is to be rendered magnetic, and drawing it slowly along several times. What is extraordinary, the end of the bar which is first touched with the magnet, will have the contrary property to the end of the magnet with which it is touched or rubbed. If, for instance, the end with which the bar is touched, is the north pole of the magnet, the end of the bar to which it is first applied will be a south pole, and the contrary.

It is obvious that the directive power of the magnet, or that which causes it when placed so as that it can freely turn of itself, to take always a position north and south, is the most useful property of the magnet. The mariner's compass is a fine needle, index, or piece of steel wire, formed like the index, or hand of a clock or watch, and

made so as to turn with great ease on the prop which supports it. The needle, or index, is fixed in a box, and underneath it the points of the compass, or the different quarters of the horizon, that is, east, west, north, and south, are marked on a card. As the magnetic needle always points towards the north, by observing the course or direction of the ship, that is, which way her head is turned, it is easy to know to what point she steers; and by keeping a regular account of the distance she traverses, the seaman can go with exactness from one place to another. Before this great and important invention, seamen usually steered by observing the fixed stars, and particularly the polar or north star.

Though the position of the magnetic needle is generally north and south, yet it is found sometimes to vary a few points or degrees from this position; and it not only varies at different places, but even at different times at the same place. This is called the *variation* or *declination* of the compass.

Magnets, while they attract other bodies, appear to be themselves subject to the attraction of the earth, for the magnetic needle, when it is placed where it can act freely, generally assumes a position with one of its poles a little elevated and the other depressed. This, however, varies in different latitudes: near the equator it is in a position almost strait or horizontal; as it approaches the northern regions, the south pole is depressed, or drawn towards the earth; and, on the other side, the equator, in the southern latitudes, the north pole is depressed. This is called the *dip* of the needle.

On Fire and its Properties.

THE objects of natural philosophy may be divided into fluid and solid bodies, terms which to attempt to define, would only serve to perplex, because they are in a great measure objects of our senses.

It is probable, as will hereafter appear, that there is but one fluid in nature, and that other bodies are rendered fluid only from the particles of that active and subtle fluid being insinuated between the particles of those bodies which appear in that state. This fluid is fire, the caloric of the French philosophers, or heat, as it has been termed

by some writers, though the word heat seems better adapted to express one of its qualities than its nature or essence. That light and the electric fluid are only forms or modifications of fire, is highly probable: but this is a subject on which it is not necessary to enter here.

The most remarkable properties of fire, are the minuteness of its particles, or its subtilty, and its wonderful elasticity, which last property renders it an exception to all other matters on this earth, in not being subject to the laws of gravitation, at least as far as we are able to judge, or, in other words, being without weight. Very many of the effects of fire will be found to depend on its elasticity.

When we speak of elementary fire, it does not follow that the body in which it is present should necessarily appear in an inflamed or burning state; this depends on the quantity, in the first place, and, in the second, on the fire being in an active state. For instance, when we feel warmed and refreshed by a fire, our bodies imbibe a certain quantity of its particles, but not sufficient to consume or injure them. Nay, it is known to a certainty, that every part of nature, even the coldest bodies to our touch, have a certain portion of elementary fire within them. It constitutes a considerable part of the air we breathe, and, indeed, it is probable, that part of it is most necessary to sustain life.

Fire is found to exist either in a latent, combined, or inactive state; or also in its active disengaged state, when it exhibits the usual phenomena of flame and culinary fire.

As elementary fire is a fluid extremely subtle, it penetrates almost all bodies, and is imbibed more or less by all; but some bodies have a much stronger attraction for it than others. Thus, though all fluidity is the effect of fire, some bodies will not melt or become fluid without a considerable accession of heat, while some have so strong an attraction for it, that they will continue fluid in the ordinary heat of our atmosphere. Thus most metals remain solid, unless exposed to the heat of a furnace, while mercury or quicksilver is fluid in a very low temperature.—Thus wax or tallow requires the application of considerable heat to melt or render them fluid, while water continues in its fluid state till the thermometer is reduced to 32 degrees, a degree of cold which is extremely uneasy to our feelings.

The effects which are wrought upon different bodies by the presence of fire, are, 1st, expansion; 2d, fluidity; 3d, boiling or evaporation; 4th, combustion.

1st, *Expansion*. Nothing is more obvious than that the admission of the matter of fire within the pores, or between the particles of any bodies, causes an immediate expansion or swelling out of the whole mass. An iron bolt that would easily pass through a ring in a cold state, will stick fast in it when heated a little in the fire. But this expansion is seen more powerfully to affect fluid than solid bodies, because there is less adhesion between their particles. Thus, if a bulb of glass, with a tube annexed to it, is half filled with spirits of wine tinged with any colouring matter, and grasped with a warm hand, the little quantity of air contained in the bulb will be expanded, and force the liquor to the other end, where it will exhibit all the phenomena of boiling. Though quicksilver is a metal, yet it has so strong an attraction for the matter of fire, that it continues in a fluid state in the ordinary heat of our atmosphere. It is therefore very easily expanded by heat or fire; and upon this principle the well known instrument, called the thermometer, or measure of heat, is constructed. It consists of a bulb, which is filled with quicksilver, and a tube, from which the air has been excluded, and which is closed at the top. The mercury, therefore, in the bulb is expanded by every increase of heat, and consequently rises in the tube, and, when the heat is withdrawn, it sinks proportionably.

From what has been said, it will be obvious, that cold means nothing but the absence of heat: for, whenever the that is withdrawn, we become sensible of cold, which therefore denotes a sensation of feeling, and not a thing. To graduate, as it is called, or mark a thermometer, it is plunged into what is called the freezing mixture, that is, salt and snow, when the mercury sinks, being deprived of its heat; and afterwards into boiling water, when the mercury rises considerably in the tube. The space between these two points is divided into two hundred and twelve equal parts, which are accordingly marked on the stem of the thermometer, or the board to which it is affixed.

When bodies assume the fluid state, a large portion of elementary fire is absorbed, and, in the language of Dr. Black, remains *latent*, that is, not sensible to o touch, at

least with respect to such substances as can be dissolved or rendered fluid with the common heat of our climate.—Thus, to melt a pound of ice, it will be found that a large portion of heat or fire must be consumed or absorbed, and yet the heat in the water so produced shall not be perceptible to our touch.

When bodies pass from a solid to a fluid state the absorption of heat by that body produces a degree of sensible cold. Thus, if any solid body can be made suddenly to melt or dissolve in the common heat of our atmosphere, a very considerable degree of sensible cold will be produced.

When bodies, on the contrary, pass from a fluid to a solid state, sensible heat is generated by the elementary fire, which is let loose or emitted. The heat produced by throwing water upon quicklime, which is the process the working men call slacking lime, must have been observed by most people. In this case the component parts of the water are absorbed into the solid mass of the lime, and the fire which held it in a fluid state is let loose.

As by the application of heat or fire solid bodies are expanded, so by a continuation and increase of it their particles are dissolved and become fluid; and if the heat continues to be accumulated, what was before a common or incompressible fluid, will be turned into an elastic fluid. In common language, it will boil, and, in process of time, go off entirely in vapour.

Boiling is evidently no other than a fluid being converted into vapour, and the point at which water begins to boil is fixed, on Fahrenheit's scale, at two hundred and twelve degrees. In this case, as well as in the former, there must be a considerable absorption or accumulation of the matter of fire before the effect can be wrought; and the water or fluid boils or bubbles up, because that part of the vessel which is nearest the fire will be most heated, and therefore the evaporation commonly commences at the bottom.

If the heat is continued after the fluid arrives at the boiling point, the whole of the fluid will fly off in vapour or steam, which, in common language, is called boiling away. Vapour is one thousand eight hundred times lighter than water, that is, a given portion of water will, in an elastic form, occupy eighteen hundred times the space it did before. Vapour, as well as air, is called an elastic

fluid, because it may be compressed like wool or feathers, and, when the pressure is removed, will recover its former dimensions. Yet it is only to a certain extent that vapour can be compressed, for its force is immense, as we may see by the amazing power which is exerted by the steam engine in working pumps and other machinery; and the bursting of one of these engines is attended with a report much greater than that of the heaviest cannon; in fact, the force of vapour is greatly superior to that of gunpowder. One hundred and forty pounds of gunpowder blew up a weight of thirty thousand pounds, but the same weight of water, converted into steam, or vapour, lifted a weight of upwards of seventy seven thousand pounds.— All smoke is vapour, and the smoke from our common coal fires proceeds from the water which is formed in the process of burning, and which is converted into vapour. It is, however, commonly mixed with some oily, bitumous, saline, or sulphureous matter from the coal, as is evident from the soot which adheres to the sides of the chimney.

Fluids will boil, or in other words, be converted into vapour with a less degree of heat than they do, if it was not for the pressure of the atmosphere. Water which boils at two hundred and twelve degrees in the open air, will, in the most perfect vacuum we can make, boil at ninety degrees, that is, it will boil in vacuo at one hundred and twenty-two degrees below its ordinary boiling or vaporific point.

4thly. *Combustion* implies the emission of fire from some body in which it existed in a latent state, and the destruction, or rather the change of some other body. Fire is contained in the largest quantity in air, and the pure part of it, that is, the oxygen, being disposed to unite with many other matters, most of the ordinary processes of combustion and inflammation are the result of the sudden union of oxygen with some other substance, in which case the fire which was contained in the oxygen air is disengaged and let loose. This fact is very clearly evinced in the combustion of phosphorus, which inflames in the common temperature of the atmosphere. Phosphorus, in fact, has a greater attraction for oxygen than almost any other substance; when, therefore, any portion of it is exposed to the air, in a certain degree of heat, the pure or vital part, that is, the oxygen, is attracted by it and con-

densed, the phosphorus is then changed into phosphoric acid, and the fire, which kept the oxygen in an aerial form, is detached, and flame is produced. With respect to other inflammable matters (coal, for instance) either they have a weaker attraction for oxygen than phosphorus, or their particles have a stronger attraction for each other; it is therefore necessary that a degree of internal agitation should previously be excited in them, or even a third substance introduced. Thus, in the ordinary process of exciting culinary fire, when a quantity of inflammable matter is heaped together, and fire introduced among it, by the action of the fire a part of it is first expanded from its solid state into the state of inflammable vapour, it comes then necessarily into contact with the pure air of the atmosphere, and the action of the fire still continuing, the fire which the pure part of the air contained is attracted from it, and the oxygen unites with the inflammable matter, and both are combined into water in the form of vapour or smoke.

Hence there can be no combustion without a supply of pure air; and therefore the common bellows, by bringing an accession of air, causes a fire to burn better. Flame is ignited vapour, and that part only which comes in contact with the air is inflamed; the flame of a candle or lamp may therefore be considered as a tube or cone of fire, the hollow part of which within is filled with the vapour which is not inflamed. It assumes the form of a cone, because the vapour being gradually consumed as it rises, the quantity is lessened in its dimensions. Flame, which is ignited vapour, always ascends, because vapour or smoke is lighter than air, and it is a well-known principle, that by the laws of gravitation, the heaviest body will be always nearest the earth, and consequently the lighter at top.

Of the Laws of Motion.

EVERY thing in mechanics depends upon very simple principles, and may be resolved ultimately into the power of gravity and the laws of motion.

In treating of gravitation, in a preceding part, it was shewn to be that kind of attraction which subsists between the mass of the earth, and all those bodies which are on its surface. It is that which, in the stated revolutions of

this planet, prevents us, and all the bodies which surround us, from falling into infinite space; and which draws so forcibly every thing whatever towards the centre of the earth.

That this attraction is greater or less at different distances is generally allowed: a body which at one semidiameter of the earth weighs a pound, will have four times less weight at two semidiameters, and nine times less at three. At small distances, however, we are not sensible of this difference in weight, for though we could not be elevated a mile above the earth's surface, when we consider its diameter is eight thousand miles, we shall easily see that the small difference which this would produce is scarcely to be estimated.

Falling bodies, however, we know, acquire an accelerated or increased force, according to the height from which they fall; but this must be accounted for from different principles. Every man is sensible, that the fall of a stone is to be dreaded in proportion to the height from which it descends. If it falls from only a foot above his head, it is not so likely to be so fatal as if it fell from the parapat of a high house. The falling body, therefore, must of necessity acquire an increase of velocity in its descent; and, in fact, it is said that a leaden bullet let fall from one of the steeples of Westminster Abbey, acquired velocity sufficient to pierce through a deal board.

This effect must therefore be referred to the first law of motion, as laid down by Sir Isaac Newton, which is, that "all bodies are indifferent to motion and rest: in other words, a body at rest will continue in that state, unless put in motion by some external impulse; and a body in motion will continue that motion for ever, unless stopped by some external obstruction." This property of matter is termed, in the technical language of philosophy, its vis inertiæ.

To apply this to the case immediately in point, it is evident that the bullet which is dropped from the steeple of Westminster Abbey, having, by the power of gravity, once acquired a certain degree of motion, would continue to fall by the motion it had received by the first impulse, even if the cause was to cease. For instance, if when it had fallen half way, it was impossible to deprive it of gravity, it would still, by the above law, continue its motion, and in the direction in which it was sent, as a stone continues to go

on, when thrown by the hand, without any new impulse.—The power of gravity, however, does not cease, and therefore every inch the bullet falls it receives an increase of motion. Thus, if in the space of one second it falls one pole (sixteen feet and a half), it will then have acquired as much swiftness or velocity as will carry it through three poles in the next second, through five in the third, through seven in the fourth, and nine in the fifth. This will account for its accelerated motion, and for the increased force with which it falls near the bottom. Thus the time which bodies take in falling is easily calculated, for if they fall about one pole in the first second, which is what they nearly do by the force of gravity, they will then fall three in the next, and in five seconds they will fall about twenty-five poles, or three hundred feet. If there was no resistance from the air, the velocity of falling bodies would be still greater, and as water is a medium more dense than air, the resistance must be greater, and the motion of a body falling in water proportionably slower.

The same principle holds with respect to projected bodies. "It seems a bold assertion," says Mr. Walker, "to say that a cannon, discharged horizontally on the top of a tall tower, shall throw a ball two miles distant; and that it shall strike a level plain, or the ground, at the same instant that another ball, let fall from the muzzle of the gun, (the moment of its discharge) shall strike it! But there is no doubt of the fact; for though the projected ball may move point blank (and bid defiance to the power of gravity half its way), it will perform that half in so short a space of time, that it will fall a rod in the first second, three rods in the second, &c. like all other falling bodies; for an horizontal impulse retards not the power of gravity, in respect of time."

As heavy bodies are uniformly accelerated in their descent, they are as uniformly retarded by the power of gravity in their ascent. Thus, if we were to throw the bullet up to the steeple of Westminster Abbey, we must give it just as much force as it acquired in its descent.

It is from the sluggishness of matter, which is called the *vis inertiæ* of bodies, that there proceeds a something like an endeavour in all bodies to preserve that state in which they are; when at rest to continue in a state of rest, and when in motion to continue in motion. This position may seem abstruse, but it will admit of illustration by the most

common facts. If we push a bowl of water with the hand, the water flies over the edge upon the hand, for it endeavours to continue in the state of rest in which it was. But if we take the bowl in our hand, and run away with it, and suddenly stop short, the water flies forward the way we were running, from its vis inertiæ, or tendency to continue in the same state of motion. In the same manner, if sitting in the front of a carriage, which, after going very fast, stops suddenly, we are jolted from our seat, our heads will drive through the front glass of the carriage.

It is a plain and obvious principle, that the greater the quantity of matter is which any body contains, the greater will be its *vis inertiæ*. The heavier any body is, the greater the power which is required, either to set it in motion, or to stop it. On the other hand, the swifter any body moves, the greater is its force, as was sufficiently exemplified in the case of a bullet, which was supposed to fall from the steeple of Westminster Abbey. Upon this easy principle depends the whole of mechanics.

The second law of motion laid down by Sir Isaac Newton is—"That the alteration of the state of any body from rest to motion, or from one motion to another, is always in proportion to the force which is impressed, and in the direction of that force."

All motion is naturally rectilinear. A bullet projected by the hand, or shot from a cannon, would for ever continue to move in the same direction it received at first, if no other power diverted its course. Therefore, when we see a body move in a curve of any kind whatever, we conclude it must be acted upon by two powers at least; one putting it in motion, and another drawing it off from the rectilinear course it would otherwise have continued to move in: and whenever that power, which bent the motion of the body from a straight line into a curve, ceases to act, the body will again move on in a straight line, touching that point of the curve in which it was when the action of that power ceased. For example, a pebble moved round in a sling ever so long a time, will fly off the moment it is set at liberty, by slipping one end of the sling cord: and will go on in a line touching the circle it described before; which line would actually be a straight one, if the earth's attraction did not affect the pebble, and bring it down to the ground. This shews that the natu-

ral tendency of the pebble, when put into motion, is to continue moving in a straight line, although by the force that moves the sling it is made to revolve in a circle.

From this maxim it will evidently appear, that when two forces act at once upon the same body, in different directions, it will go in neither, but in a course between both.

If both forces act upon the body in such a manner, as to move it uniformly, the diagonal described will be a straight line, but if one of the forces acts in such a manner as to make the body move faster and faster, then the line described will be a curve. And this is the case of all bodies which are projected in rectilinear directions, and at the same time acted upon by the power of gravity, which has a constant tendency to accelerate their motions in the direction wherein it acts.

This last is an observation of great importance, as it is the foundation of the beautiful system of Newton concerning the planetary motions. The force which impels these bodies forward in a rectilinear direction, is called the *centrifugal* force, as driving them from the centre; and the force which draws them towards the centre, or the power of gravity, is called the *centripetal* force.

The third law is, that "re-action is always equal to action." In other words, the resistance of a body at rest, which is acted or pressed upon, acts against a moving body with a certain degree of power, and produces the same effects as an active force would have done in the same direction. Thus, if we strike an anvil with a hammer, the anvil strikes the hammar with the same force with which it is struck itself. Hence a common trick in the country, of a man lying on the ground with a large anvil on his breast, and suffering a strong man to strike it with a sledge hammer with all his might. If the anvil is very large, its *vis inertiæ* resists the force of the blow, and the man is perfectly safe. If the anvil was very small, only the weight of a pound or two, the first stroke would kill the man.

Hence it is evident, that when a load is drawn by a horse, the load acts against the motion of the horse, and the action of the animal is as much impeded by the load, as the motion of the load is prompted by his efforts.

Before we proceed to the consideration of the six me-

chanic powers, it is necessary to say a few words on what is called the *center of gravity*.

The center of gravity is that point of a body in which the whole force of its gravity or weight is united. Whatever, therefore, supports that point, bears, in fact, the weight of the whole body; and while it is supported it cannot fall, because all its parts are in perfect equilibrium about that point. Thus, if we endeavour to balance a cane, by laying it across upon our finger, after some time we find a place where neither end will preponderate. The part, then, which rests upon our finger is the center of gravity. An imaginary line drawn from the center of gravity of any body towards the center of the earth, is called the *line of direction*, and it is in this line all heavy bodies will descend.

The difficulty of sustaining a tall body upon a narrow foundation will be evident, if we attempt to balance a cane with its small end upon our finger. Its center of gravity is somewhere about the middle of the cane, and unless we have sufficient dexterity to keep the foundation on our finger perpendicular under the center of gravity, it will undoubtedly fall. In this consists the great difficulty of posture masters and rope dancers. The dancer on the rope balances himself with a long pole loaded with lead, and keeps his eye steadily on some point exactly parallel to the rope, by which he can see whether his center of gravity is either on one side or the other of his slippery foundation, and if any irregularity takes place, he rectifies it by his balancing pole.

All bodies stand firm on their bases, when the line of direction falls within the base; for in this case the body cannot be made to fall, without first raising the center of gravity higher than it was before.

The nearer the center of gravity, and the line of direction coincide, the firmer any body stands upon a horizontal plane. If the plane is inclined, a body will slide down it, if the line of direction falls within the base; but it will tumble down when that line falls without the base.

The broader the base, the firmer any body stands; thus we find we stand firmer with our feet a little asunder, than when close together; and, in the former case, it will require a much greater force to push us down. Whenever the line of direction, however, falls without the base of

our feet, we necessarily fall; "and it is not only pleasing," adds Mr. Ferguson, "but even surprising, to reflect upon the various and unthought of methods and postures which we use to retain this position, or to recover it when it is lost. For this purpose we bend our body forward when we rise from a chair, or when we go up stairs; and for this purpose a man leans forward when he carries a burden on his back, and backwards when he carries it on his breast; and to the right or left side as he carries it on the opposite side. A thousand more instances might be added.

Of the Mechanic Powers.

MAN, considered as to his bodily structure, is but a feeble creature; it is mind which gives him a superiority over other animals. Contrivances to assist his natural powers, we have reason to believe, took place at a very early period of society, as we find few nations, even in the most savage state, which are entirely without them. It is philosophy, however, which explains their theory and uses, and which extends their application.

When we survey the vast variety of complex machines, which one of our great manufactories, for instance, exhibits, we are struck with astonishment, and the creative genius of man appears to the greatest advantage; but the surprise of the unscientific person will be increased when he learns that this vast assemblage of mechanism is reduced into six simple machines or powers, from which, and their different combinations, the most stupendous works of human art are produced. These machines are, 1. the lever; 2. the wheel and axle; 3. the pulley; 4. the inclined plane; 5. the wedge; and 6. the screw.

1. The *lever* is, perhaps, the simplest of all the mechanic powers, and was probably the first which was brought into use. It is a bar of iron or wood, one part of which is supported by a prop, and upon that prop all the other parts turn as on their centre of motion. You see the lever made use of in one form or other every day; when a labourer takes a handspike, or large stake, and putting a stone under some part near the end, by putting the extremity under a cask, a piece of timber, or any other body, and attempts to move it, by pulling at the other end, he

makes use of a lever. The handle of a pump is a lever also; even the poker with which we raise the fire is a lever, the bar of the grate is the prop, and the end which we hold in our hands is the strength or power. This is, however, not the only kind of lever, for in fact there are three different ways of using the lever, and from the different ways of using it, it is called a lever of the first, second, or third kind, viz. of the first kind, when the weight is on one side of the prop, and the power on the other: of the second kind, when the weight is between the prop and the power; and of the third kind, when the power is between the prop and the weight.

Many instruments in common use are levers of these kinds, thus pincers, sheers, and snuffers are compounded of two levers of the first kind. Cutting knives used by druggists are levers of the second kind, and so are doors, oars, and bellows. A ladder, reared by a man against a wall, is a lever of the third kind, and so are all the bones and muscles of animals.

The *wheel and axle* is an engine consisting of a wheel fixed upon the end of an axle, so that they both turn round together at the same time. The power being applied at the circumference of the wheel, the weight to be raised is fastened to a rope that coils round the axle. The capstan used on ship-board, for the purpose of weighing anchors, is a cylinder of wood with holes in it, into which are put bars or levers to turn it round; these are like the spokes of a wheel without the rim. Sometimes the axis is turned by a winch fastened to it, which in this respect serves for a wheel, and is more powerful in proportion to the largeness of the circle it describes, compared with the diameter of the axle.

A *pulley* is a small wheel moveable round an axis, called its centre pin, with a drawing rope passing over it. The chief use of the single pulley is to change the direction of the power from upwards to downwards, and to convey bodies to a great height or distance, without a person moving from his place.

The *inclined plane* is made by planks, bars, or beams laid aslope; by which large and heavy bodies may be more easily raised or lowered, by sliding them up and down the plane; and the increase of power is in the proportion of the length of the plane to its height. In drawing a weight

upon an inclined plane, the power acts to the greates vantage, when its direction is parallel to the plane.

The *wedge*, which resembles two inclined planes, is useful to drive in below very heavy weights, to raise only a small height, and to cleave and split blocks of and stone. The power exerted by it is in proporti the slant side to half the thickness of the back. So if the back of a wedge be two inches thick, and the twenty inches long, any weight pressing on the back balance twenty times as much acting on the side. the great use of a wedge lies in its being urged n pressure, but usually by percussion, as by the blow hammer or mallet; by which means a wedge may be d in below, and so be made to lift almost any weight, a largest ship, by a men striking the back of a wedge w mallet.

The *screw* is a kind of perpetual inclined plan power of which is still farther assisted by the additi a handle or lever, where the power acts; so that the in power is in the proportion of the circumference de ed, or passed through by the power to the distanc tween thread and thread in the screw. The uses to the screw is applied are various, as the pressing of b close together, such as the press for napkins, for binders, packers, hot-pressers, &c.

The application of these mechanical powers to va experiments, and to compound machines, to the regul of motion by fly-wheels, the construction of mills of va kinds, clock-work, and wheel-carriages, it would e our limits to describe.

Of Hydrostatics.

THE word Hydrostatics implies the science whi lates to the weight of water, compared with that of bodies; but the science, as now taught and culti treats not only of the weight and pressure, but of thing relative to the action and mechanical properti fluids in general, or, at least, of the dense or incomp ble kind, such as water, &c.

Though water is generally regarded as incompres yet it is not wholly so, since it is capable of transm sound, which proves that it is elastic, and every e

body must be compressible. To prove the fact, however, the Florentine academicians filled a globe perfectly full with water, and afterwards closed the orifice by a tight screw. The globe was then put into a press of considerable force; it was a little flattened at the sides by the force of the press, but was proportionably extended in other parts of its surface, so that it was concluded that the water did not occupy less space than before. On pressing it still harder, the water was made to exude through the pores of the gold, and adhered to its surface like drops of dew. From this experiment it may be inferred, that if water is indeed capable of compression, it is so only in a very slight degree, since, instead of yielding to the force of pressure, it found its way out through the pores of the metal.

The first principle that may be laid down with respect to the pressure of fluids is, *that of all waters which have a communication, the surface, while they are at rest, will be perfectly level.*

Upon this principle it will be evident, that water conveyed under the earth through conduit pipes, will always rise to the level of the reservoir whence it is drawn. It is in this manner that the cities of London and Westminster are supplied with water, either from the London Bridge water-works or the New River. In the former case, water is raised from the Thames by immense pumps worked by wheels, which are turned by the tide, to a reservoir, which is placed as high as the highest part of the town whither water is to be conveyed by pipes; and, in the latter, it is well known that the reservoir of the New River stands on a rising ground near Islington, which is higher than any of the places where the pipes terminate.

The reason why the water thus rises to its level, is because *fluids press equally on all sides.*

Another maxim in hydrostatics, of equal importance with the former is, that *every body lighter than water, or, in other words, which swims in water, displaces exactly as much of the water as is equal to its own weight.*

Hence it is plain, that a boat or other vessel sailing upon the water, displaces exactly as much of the fluid as is equal to the vessel and its lading, and, if more weight is added, it will sink deeper in the same proportion, or, in other words, a weight of water equal to the added lading

will be displaced, whence a laden ship is said to *draw more water*, that is, to sink deeper than when it is light or unloaded.

Every body, on the other hand, which is heavier than water, or which sinks in water, displaces so much of the water as is equal to the bulk of the body sunk or immersed in the water. Thus, it is plain, that if a leaden bullet is dropped into a vessel of water, it will take up just as much room as a small globe of water of equal dimensions. On this principle is founded the tables of specific gravities, and what is called the hydrostatic balance; for since every body that sinks, displaces a quantity of water exactly equal to its own bulk, it follows, that *every body, when immersed in water, loses so much of its weight as is equal to the weight of an equal bulk of water.* Thus, if the body when weighed in air is two ounces in weight, and an equal bulk of water is one ounce, it will of course lose, when weighed in water, one ounce of apparent weight. It is by this means that adulterate metals or coins are distinguished from the true ones; thus copper is bulk for bulk heavier than tin, and gold is heavier than copper or brass, which is a mixture of copper and zinc. If, therefore, a brass counter is offered for a guinea, though it may not to the eye appear much larger than a real guinea, yet you may depend upon it that it is so in fact. We then take a guinea, which we are sure is real gold, and weighing it first in air, and then in water, we find it loses about one-nineteenth of its weight in the latter. We then weigh the brass counter in the same way, and find it loses about one-eighth, which, you see, is much more, and therefore we cannot doubt but the coin is made of base metal. When you look at tables of specific gravities, you see the specific gravity of gold put down at about nineteen one-half, of mercury at about thirteen one half, lead eleven one-quarter, silver ten one-quarter, copper eight one half, iron seven one-half, tin seven one-quarter, &c.; that is, gold is nineteen times one half heavier than its bulk of water, and consequently loses more than one-nineteenth of its weight in that fluid.

It is upon the same principles that the density of different fluids is put to the test. It might, it is true, be ascertained by weighing them against each other in different scales; but it may be done in a more easy and expeditious

ıer upon the hydrostatic plan, since the same body will sink in one fluid, will swim in another, and the body will sink to different depths in different fluids. old women in the country try the body of their mead ›ther liquors, by observing whether an egg will swim em, which will sink in common water. The exact re- : weight of fluids may be ascertained by suspending one end of an accurate balance, either a small globe, conical piece of glass. Its weight in water being pre- ly ascertained, which suppose to be two hundred and 'e grains; if it is immersed in a fluid heavier than wa- ome weights must be added in the opposite scale, as ıstance, if it is sea-water, ten grains must be added, h will make the relative weight of sea-water to com- water, as four hundred and twenty-two to four hun- and twelve; if, on the contrary, it is immersed in dy, which is less dense, and consequently lighter than r, you will find it necessary to take out of the opposite about forty grains, and then the relative weight of ly to water will be as three hundred and seventy-two ır hundred and twelve, or about one-tenth lighter.

very convenient instrument is made use of by excise- officers of the customs, and all whose business is to 'tain the density or strength of liquors. It is called a ometer, and is nothing more than a small hollow globe ass or metal with a stem to it, like the handle of a tee- n, but longer, which stem is marked or graduated.— instrument is made so, that the ball sinks in water, ıot entirely, and therefore a part of the stem is al- above the surface. If it is immersed in a fluid light- an water it will sink, and less of the stem will be e the surface; if in a heavier fluid it will rise higher, more of the stem will be seen.

'oof-spirit consists of half water and half pure spirit; is such as when poured on gunpowder and set on fire, burn all away; and permit the powder to take fire flash, as in open air. But if the spirit be not so high- ctified, there will remain some water, which will make ›owder wet, and unfit to take fire. Proof spirit of any weighs seven pounds twelve ounces per gallon.

ıe common method of shaking the spirits in a phial, raising a head of bubbles, to judge, by their manner sing or breaking, whether the spirit be proof or near

it, is very fallacious. There is no way so certain, and at the same time so easy and expeditious, as this by the hydrometer; which will infallibly demonstrate the difference of bulks, and consequently the specific gravities in equal weights of spirits, to the thirty, forty, or fifty thousandth part of the whole; which is a degree of accuracy no one can wish to exceed.

To the science of hydrostatics, belongs the construction of that curious machine, called the diving bell. It is an empty vessel in the form of a bell inverted, and made so heavy as to sink in water. Its ingenious inventor, Dr. Halley, was one of five persons, who, inclosed in a diving-bell, were let down to the depth of nine or ten fathoms of water for above an hour and a half at a time, without experiencing any ill effects. He says he might have continued there as much longer as he pleased. By the glass above, so much light was transmitted, when the sun shone, and the sea was clear and even, that he could see perfectly well to read and write, and to take up any thing that was under the bell; and by the return of the air-barrels, he could send up orders, written with an iron pen on small pieces of lead, when he wanted to be removed from place to place. But in misty weather, or when the sea was rough, it was nearly dark in the bell, and he was then obliged to burn a candle, which consumed about as much air as one person.

Of Hydraulics.

Hydrostatics, we have seen, is that science which relates to the weight and pressure of fluids; the science of Hydraulics teaches us what respects the motion of fluids, and the means of raising them by pumps, and conducting them by pipes or aqueducts from one station to another.

It was laid down as a principle, in the preceding article that of all waters which communicate with each other, the surface will be level, or, in common language, that water will rise to its level, or to the same height as its source.—The reason of this was not fully assigned then, because it was not necessary; it was observed, that fluids press equally on all sides, but the true reason of the level surface of water is the pressure of another fluid, that is, the air or at-

mosphere, which, as it bears equally on all points of the earth's surface, must equally press the source from which water is derived; and the orifice of the tube or pipe in which it rises.

That water will not flow unless exposed to the pressure of the atmosphere, will be plain from filling a cask or other vessel perfectly full of this fluid. If the bung is perfectly tight, and there is no aperture above for the air to press upon it and force it out, it is in vain that we shall attempt to draw it off by opening a passage for it below. Hence the use of vent holes, and of vent pegs, in casks, by raising the vent peg air is admitted, which forces the liquor to flow out at the cock or fosset, whereas if the vent peg was kept tight, no liquor whatever could be obtained.

It is by the pressure of the atmosphere that the common or sucking pump is enabled to act. It is said to have been invented by a mathematician of the name of Ctesbes, about one hundred and twenty years before Christ; but the principle on which it acted was unknown till the last century Mankind, perfectly ignorant that the air had weight, attempted to account for these effects by a maxim not only unfounded, but even destitute of meaning. That was, "that nature abhorred a vacuum." What they meant by *Nature* is as little to be understood, as when the same word is used by those ignorant and absurd persons who affect to deny the existence of a God. Absurd, however, as this maxim was, it remained uncontradicted till within these one hundred and fifty years, when it met with a practical refutation. About that time some workmen were employed by the Duke of Florence, to raise water by a common sucking pump to the height of fifty or sixty feet. A pump was accordingly constructed for that purpose, but, after all their efforts, they were unable to raise it above the height of thirty-two feet. It was then found, either that nature had not this horror of a vacuum, or, at least, that it was a very limited kind of a horror; for why should nature have a horror of a vacuum at one height, and not at another? The matter was referred to the famous astronomer and philosopher Galileo, but, strange to relate, he was unable to solve the difficulty!

The difficulty is, however, now explained. A pump is a hollow piece of timber, to the bore of which a piston, bucket, or sucker, is exactly fitted. The piston has a

valve in it made with leather, like the clapper of a bellows. When the piston is forced down, therefore, the air, or any fluid contained in the pump, will force it open; and when the piston is drawn up, the pressure of the air or water, which has been admitted in that way, will keep the valve down. It is found, however, that a column of water, of thirty-two or thirty-three feet high, is equal in weight to a column of water of the same diameter or thickness of the whole height of the atmosphere. Consequently, the pressure of the atmosphere can never force water through any vacant space higher than thirty-three feet. By the action of a common pump, of four inches bore, and thirty feet high, a single man can discharge twenty-seven gallons and a half of water in a minute; if the pump is only ten feet above the surface of the well, the quantity discharged in that time is eighty-one gallons six pints.

The forcing pump is upon a different plan. Here the piston is without a valve, and the water which rises through the valve in the box, is forced out by the depression of the solid piston.

By the means of forcing pumps, water may be raised to any height above the level of a stream or spring, provided the machinery is sufficiently powerful to work them.—The London-bridge water-works, which supply the city of London with water, consist of a certain number of forcing pumps, which are worked by large wheels turned by the tide. There is also a beautiful engine of this kind at the Duke of Marlborough's, at Blenheim.

The most powerful forcing pumps, however, are wrought by steam engines, for steam is one of the strongest powers in nature. The steam engine consists of a large cylinder or barrel, in which is nicely fitted a solid piston, like that of a forcing pump. The steam is supplied from a large boiler close by, and is admitted into the cylinder by an orifice, which can be occasionally shut. The force of the steam lifts the piston, to the top of which is affixed a long lever to work a forcing pump, or for any other purpose; and when the piston is lifted a certain height, it opens a small valve in the top of the cylinder, through which a small quantity of cold water being admitted, the steam is condensed, and thus a vacuum being created, the piston again descends, and is again lifted up by the force of the steam.

It would far exceed the limits of this work, to enter into an examination of all the steam engines invented by different persons. It is sufficient to mention, that no engine of this kind has been found upon careful trial, to be superior to those of Mr. Watt.

It may not be improper here to state the actual performance of some of these engines, as they have been ascertained by experiment.

An engine, having a cylinder of 31 inches in diameter, and making 17 double strokes per minute, performs the work of forty horses, working night and day, (for which three relays, or 120 horses, must be kept) and burns 11,000 pounds of Staffordshire coal per day. A cylinder of 19 inches, making 25 strokes, of 4 feet each, per minute, performs the work of 12 horses working constantly, and burns 3700 pounds per day. A cylinder of 24 inches, making 22 strokes of 5 feet, burns 5500 pounds of coals, and is equivalent to the work of 20 horses.

Optics.

THIS is a beautiful and interesting branch of science, for it relates to the properties of light, which is the most rapid, subtle, and divisible of all bodies; and to the structure of the eye, the most wonderful organ of the human frame.

Optics explain the manner in which vision is effected, assign the reasons of the several alterations which the rays of light undergo in the eye, and shew for what causes objects appear at different times greater or smaller, more distinct or confused, nearer or remote. In this extensive signification, the science is considered by Sir Isaac Newton in his work on this subject.

The more the properties of light are investigated, the more astonishing they appear. A succession of the particles of light, following each other in a straight line, is called a ray of light; and this ray, in whatever manner its direction may be changed, whether by refraction, reflexion, or inflexion, always preserves a rectilinear course till it be again changed; neither is it possible to make it move in the arch of a circle, ellipsis, or other curve. A proof of this, we cannot see objects through a crooked tube.

Refraction is the deviation of a ray of light from its

straight course, on passing obliquely out of one medium into another of a different density. This may be proved by an easy experiment. Put a piece of money into an empty bason, and walk back till you have just lost sight of the money, which will be hid by the edge of the bason. Then pour water into the bason, and you will see the piece of money distinctly, though you look at it from exactly the same spot as before.

The *Reflexion* of the rays of light from the surface of bodies, is the means by which these bodies become visible. And the disposition of bodies to reflect this or that kind of rays most copiously, is the cause of their being of different colours. When light strikes upon any surface, it is so reflected, that the angle of reflexion is equal to the angle of incidence. This is one of the fundamental laws of optics, and upon this the properties of mirrors depend.

Inflection is a property, by reason of which, when rays of light come within a certain distance of any body, they will either be bent from it, or towards it, this property being a kind of imperfect reflexion or refraction. It was discovered by Sir Isaac Newton. The particles which compose a ray of light are exceedingly small. For a proof of this, if a hole be made through a piece of paper with a needle, rays of light from every object on the further side of it are capable of passing through it at once without the least confusion; for any one of those objects may as clearly be seen through it, as if no rays passed through from any of the rest. That these particles proceed from every point of the surface of a visible body, and in all directions, is clear; because wherever a spectator is placed, with regard to the body, every point of that part of the surface which is turned towards him, is visible to him. That they proceed from a body in right lines, we are certain, because just so many and no more will be intercepted in their passage to any place, by an interposed object, as that object ought to intercept, supposing them to come in such lines.

The velocity with which they fly from the surface of the visible body, is no less surprising than their minuteness.— Light has been calculated to move at the rate of 180,000 miles in a second. The method by which philosophers estimate its velocity, is by their observations on the eclipses of Jupiter's satellites, which eclipses appear to us about

seven minutes sooner than they ought to do by calculation, when the earth is placed between the sun and him, that is, when we are nearest to him; and as much later when the sun is between him and us, at which time we are farthest from him; from whence it is concluded, that they require about seven minutes to pass over a space equal to the distance between the sun and us, which is about eighty one millions of miles.

Light is not a simple unmixed body, but is compounded of different species, and each species is disposed both to suffer a different degree of refrangibility in passing out of one medium into another, and to excite in our mind the idea of a different colour from the rest. Bodies appear of that colour, which arises from the composition of the colours, which the several species they reflect are disposed to excite. To prove this, let a room be darkened, and the sun be permitted to shine into it through a small hole in the window-shutter, and be made to fall upon a glass prism; then will the sun's rays, in passing through it, suffer different degrees of refraction, and by that means be divided into different rays, which, being received upon a sheet of white paper, will shew the following colours in regular order, viz. red, orange, yellow, green, blue, indigo, and violet; and if the whole image be divided into 360 equal parts, the red will occupy 45, the orange 27, the yellow 48, the green 60, the blue 60, the indigo 40, and the violet 80.

As a ray of the sun may be separated into these seven primitive colours, so by their mixture in the due proportions, may *white* be produced. White, therefore, is the mixture of all the colours, as black is the absence or deprivation of colour; and this may be proved, for by fixing pieces of cloth of all the seven different colours on the rim of a wheel, and whirling it round with great velocity, it will appear to be white.

The most remarkable instance of the separation of the primary colours of light, is that of the rainbow. It is formed in general by the reflection of the solar rays from the drops of falling rain. The artificial rainbow may be produced, even by candlelight, on the water which is ejected by a small fountain, or jet d'eau. These appearances are of the same nature, and depend on the same cause, that is, the refrangibility of the rays of light.

In order to understand more fully the science of optics, it is necessary to consider the structure and the formation of the human eye, and to observe how admirably it is adapted to the purposes of sight.

The eye lids, like two curtains, protect and cover the eyes during sleep; when we are awake, they diffuse by their motion, and by peculiar organs of secretion, a fluid over the eye, which cleans and polishes it, and renders it more adapted to transmit the rays of light. The eye itself is of a globular form, but more protuberant on the fore part than behind. The eye has three coats or membranes, called the *sclerotica*, the *choroides*, and the *retina*. Of these the most curious is the retina. It is a fine and delicate membrane, and is spread like a net over the concave surface of the choroides. It serves to receive the images of objects produced by the refraction of the different humours of the eye, and painted, as it were, upon its surface. It is transparent, but appears black by reason of a black liquid spread underneath it. From the under part of the eye, but not from the centre part, proceeds the *optic nerve*, which is supposed to convey to the brain the sensations produced upon the retina.

The coats of the eye, which invest and support each other, after the manner of the concentric coats of an onion or other bulbous root, inclose three transparent bodies, called the *aqueous*, *chrystalline*, and *vitreous* humours— The aqueous humour is the most fluid, and is thin and clear like water; it is divided into two portions by the iris which swims in it. The iris consists of two kinds of muscular fibres. The former are extended from its extremity, like the radii of a circle, and point towards the middle of the pupil as to a centre; the other fibres are circular, and surround the pupil, having the middle of it for their common centre. These are connected to the former, where they cross them, and therefore when these contract, the pupil is diminished; when they dilate, it is enlarged. This action takes place according to the distance or remoteness of objects, or the increase or decrease of light. The chrystalline humour is as transparent as the purest chrystal, but in consistence is like hard jelly. Its form is that of a double convex lens, but more convex on the interior, than on the inferior surface. It is contained in a very strong transparent membrane,

called the *arachneides*, and is suspended behind the aqueous humour by the ligamentum ciliare. The vitreous humour receives its name, like the others, from its appearance, which is like melted glass. It is not so hard as the chrystalline, nor so liquid as the vitreous humour. These humours are of firm texture and soft substance, and are best situated according to the most exact rules of optics, for collecting the rays of light to a point.

These principles, which relate to the properties of light and the structure of the eye, lead to many curious researches. For the manner how sight is effected, the power of burning glasses, the construction of microscopes, and telescopes of various kinds, whether solar, double, or acromatic, and their progressive improvement; and for a description of the multiplying glass, the camera obscura, in which objects are represented as they are upon the retina of the eye, reference must be made to the best writers on the subject.

Acoustics.

ACOUSTICS is that science which instructs us in the nature of sound. It is divided by some writers into Diacoustics, which explains the properties of those sounds that come distinctly from the sonorous body, to the ear, and Catacoustics, which treats of reflected sounds; but this distinction is not necessary.

Sound is the undulatory or wave-like motion of the air, arising from the *tremulous* motion of the parts of any body, occasioned by a stroke; and those undulations, or pulses of the air, beating on the *tympanum*, or drum of our ears, convey, by the nerves, this sensation to our minds.

The vibrations and tremors of the air, excited by the percussion of any body, are propagated in concentric spheres all around the said body (which is their common center) to very great distances; and therefore let a person be any how, or any where situated within the verge of those motions, he will equally hear the *sound*, at equal distances from the body whence it comes.

Experience has taught us, that sound travels at about the rate of 1142 feet in a second, or near 13 miles in a minute; nor do any obstacles hinder its progress, a contrary wind only a small matter diminishing its velocity.—

The method of calculating its progress is easily understood. When a gun is discharged at a distance, we see the fire long before we hear the sound. If, then, we know the distance of the place, and know the time of the interval between our first seeing the fire, and hearing the report, it will shew us exactly the time the sound has been in travelling to us. For instance, if the gun is discharged a mile off, the moment the flash is seen, you take a watch and count the seconds till you hear the sound; the number of seconds is the time the sound has been travelling a mile. Again, by the above axiom, we are enabled to find the distance between objects that would be otherwise immeasurable. For example, suppose you see the flash of a gun in the night at sea, and tell seven seconds before you hear the report, it follows therefore, that the distance is seven times 1142 feet, that is, 24 yards more than a mile and a half. In like manner, if you observe the number of seconds between the lightning and the report of the thunder, you know the distance of the cloud from whence it proceeds.

Derham has proved, by experiment, that all sounds whatever travel at the same rate. The sound of a gun, and the striking of a hammer, are equally swift in their motions; the softest whisper flies as swiftly, as far as it goes, as the loudest thunder.

To these axioms we may add the following:—Smooth and clear sounds proceed from bodies that are homogeneous, and of an uniform figure; and harsh or obtuse sounds, from such as are of a mixed matter and irregular figure.

The velocity of sound, is to that of a brisk wind as fifty to one.

The strength of sounds is greatest in cold and dense air, and least in that which is warm and rarefied.

Every point against which the pulses of sound strike, becomes a centre from which a new series of pulses are propagated in every direction.

Sound describes equal spaces in equal times.

The *sound* of bodies endures in proportion to the number of vibrations made therein by the *stroke*, each vibration producing a wave in the air, and each wave repeating the *sound*; but still more and more faint, as the vibrations are less and less, till they entirely cease: This is easy to

be observed by the ear in bells, and by the eye in a string under tension.

An echo is the repetition of *sound*, made by a reflexion or repercussion of a wave of *sound*, from the surface of very hard and smooth obstacles, as walls, &c. whence flying back, it re-salutes our ears with the same *sound* again.

The notes and tones of *sound*, arise from the peculiar nature of the sonorous body, the manner and degree of percussion, and the different make and configuration of the organ or instrument of *sound*; all these contribute to make that wonderful variety and difference in the tunes, notes, or tones of *sound*.

There is probably no substance which is not in some measure a conductor of sound; but sound is much enfeebled by passing from one medium to another. If a man, stopping one of his ears with his finger, stops the other also by pressing it against the end of a long stick, and a watch be applied to the opposite end of the stick, or of a piece of timber, be it ever so long, the beating of the watch will be distinctly heard; whereas, in the usual way, it can scarcely be heard at the distance of 15 or 18 feet. The same effect will take place if he stops both his ears with his hands, and rests his teeth, his temple, or the cartilaginous part of one of his ears against the end of the stick. Instead of a watch, a gentle scratch may be made at one end of a pole or rod, and the person who keeps the ear in close contact with the other end of the pole, will hear it very plainly. Thus, persons who are dull of hearing, may, by applying their teeth to some part of an harpsichord, or other sounding body, hear the sound much better than otherwise.

If a person tie a poker, or any other piece of metal on to the middle of a strip of flannel about a yard long, then press with his thumbs or fingers the ends of the flannel into his ears, while he swings the poker against any obstacle, as an iron or steel fender, he will hear a sound very like that of a large church bell.

Sound, like light, after it has been reflected from several places, may be collected in one point, as into a focus; and it will be there more audible than in any other part, even than at the place from whence it proceeded.—On this principle it is, that a *whispering gallery* is constructed.

Of Electricity.

If the electrical fluid is not the matter of fire, as has been conjectured, it resembles that element in so many of its phenomena and effects, that there is reason to believe it a combination of that element with some other substance. But of the nature of that combination we are at present ignorant.

The electric matter resembles the matter of fire in its most usual effect, the power of igniting or setting on fire inflammable bodies; in melting metals; in the emission of light; and in the velocity of the electric light. Friction, which is known to produce heat and fire, is also the most powerful means of exciting electricity; heat also extends itself most rapidly in humid bodies and metals, and these are the best conductors of electricity; and, as heat or fire is the most elastic of all fluids, and perhaps the greatest cause of repulsion, so the electrical repulsion may, perhaps, be referred to the same principle.

On the contrary, there are some facts which seem to prove that the electric matter is somewhat different in its nature from pure elementary fire. The electric matter affects the organs of scent; its progress may also be arrested by certain matters, which, on that account, are called non conductors; glass, in particular, which admits the passage of both heat and light, stops the course of the electric matter; on the contrary, the electric fluid will adhere most tenaciously to some other bodies, without diffusing itself even to those which are in contact with them: thus an electric spark has been drawn by a wire through the water of the river Thames, and has set fire to spirit of wine on the opposite side.

The principal phenomena of electricity are, first, the electrical attraction and repulsion. Secondly, the electrical fire rendered visible; and, thirdly, the power which certain substances possess of conducting the electrical matter; whence arise the distinction between conductors and non conductors, or non electric and electric bodies.—The electric are those which are capable of being excited, such as glass, amber, &c. but do not conduct; the non-electrics are such as conduct the electric matter, but can not be excited to produce it, such are metals, stones, and all fluid matters.

The bodies which do not conduct the electric fluid are

most capable of exciting it, and are supposed to be naturally charged or loaded with a quantity of it. They have, therefore, been called electrics; such are amber, jet, sulphur, glass, and all precious stones, and resinous substances; and the dried part of animals, except the bones, such as hair, wool, silk, &c. On the contrary, stony substances in general, allum, pyrites, vitriolic acid, black lead, charcoal, and all kinds of metals are among the non-electrics, or those which conduct the electric fluid.

Soon after the discoveries, as above related of Mr. Grey, both the English and German philosophers contrived means of accumulating the electric matter, and increasing its effects. Not only the electric fire was rendered visi[illegible], but it was made to pass from one conducting body to [illegible]ther. Spirits and other inflammable matters are easily [illegible] on fire by the electric spark; and animal bodies were [illegible]le to feel what is called the electric shock, that is, the [illegible]asy sensation felt on the electric fluid passing through [illegible] part of our bodies.

[illegible]When electrical machines were first constructed, instead [illegible] a cylinder, a glass globe was made use of; and when this was turned, the hand of the operator was applied to it, and afterwards a piece of glove leather; but the most effectual and easy means is now found to be a leather cushion, covered or smeared over with what is called an *amalgam*, or a mixture of tin and mercury. A small chain is also annexed to the apparatus, in order to make a communication with the earth. When the chain is laid over that conductor which communicates with the cushion, then that conductor is no longer insulated, but an immediate communication is established with the earth; if, on the contrary, the chain is taken from it, and laid over the prime conductor, different effects are produced, which we shall endeavour hereafter to explain.

It is scarcely necessary to observe, that the electrical power is excited by turning the cylinder pretty quickly round, while it rubs against the cushion. On turning the cylinder for a little time in this manner, you will find that the sparks may be drawn by your knuckle from the prime conductor, which is then charged or loaded with the electric matter, and this matter has, you will perceive, a kind of sulphureous smell. Again, if a metal plate is placed at some distance beneath the conductor, and some light bodies, such as feathers, straws, or little images of men and women cut in paper are presented to it, you will find that

they will be first attracted to the conductor, they then become in effect conductors themselves, and, as soon as charged with the electrical matter, they will be *repelled;* they will then fly to the plate, and discharge the electricity they have received, and then be in a state to be attracted again, when they will again fly up to the *conductor;* and a very curious effect is produced by the little images being thus put in motion by a kind of magical power.

The human body itself may, in this manner, be made a *conductor;* but to enable it to accumulate any quantity of the electric matter, the man must be insulated, that is, some non-conducting substance must be placed between him and the earth, and he must stand upon a cake of rosin, wax, or sulphur, or upon a stool with glass legs. If, then, he lays his hand upon the conductor, his body will be filled with the electrical matter, and sparks may be drawn from any part, upon being touched by another person; and each spark will be attended with a crackling noise, and a painful sensation to each party. If, in the same circumstances, spirit of wine is presented to the man in a metal spoon, when he touches it with his finger it will be set on fire; and gun-powder, or any other very inflammable substance, may be kindled in the same manner.

As metals are the most powerful conductors of electricity, if a wire of iron, or any other metal, is suspended by silken cords, (that is, *insulated*) the electric matter may be conveyed to an immense distance, through dry air, for air is a non-conducting substance when not moist, and therefore will not draw away the electric matter. In this manner some French philosophers conveyed the electric fire through a circuit of three miles. Nay, though water is a conductor, yet not being so powerful as metals, Dr. Watson, of Lincoln's Inn Fields, conveyed (as has been observed,) the electric fire by means of a wire through the Thames, and it set fire to spirit of wine on the opposite side.

When any body contains a superfluous quantity of the electric fluid, it is then, according to the Franklinean theory, electrified *positive* or *plus;* when it contains less than its proper share, it is said to be negative or electrified *minus*, that is, some of its electricity is taken from it. If a rough and smooth body are rubbed together, the smooth body in general will have the positive electricity, and the rough the negative. Thus, in the ordinary operation of the electrical

machine, the cylinder is positively electrified or plus, and the rubber negative or minus; and the redundancy of the positive electricity is sent from the cylinder to the prime conductor.

Electricity accelerates the exporation of liquors, and the perspiration of animals. There is reason also to apprehend that it is not without effect on the vegetable creation, as from some experiments we are led to conclude, that plants which have been electrified vegetate earlier and more vigorously than those which have not been subjected to its influence.

Electricity is, indeed, a most powerful agent in nature, and we are probably not yet acquainted with all its effects. It is, however, in the atmospherical pheuomena that these effects are most apparent and most tremendous. It is to Dr. Franklin that we are indebted for the amazing discovery, that the cause which produces thunder and lightning is precisely the same with that which produces the ordinary phenomena of electricity.

This truly eminent philosopher was led to the discovery by comparing the effects of lightning and those produced by an electrifying machine, and by reflecting that if two gun-barrels, when electrified, will strike at two inches with a loud report, what must be the effect of ten thousand acres of electrified cloud. After much thought upon the subject, he determined to try whether it was not possible to bring the lightning down from the heavens. A thought at once daring and sublime! With this view he constructed a kite, like those which are used by school-boys, but of a larger size and stronger materials. A pointed wire was fixed upon the kite, in order to attract the electrical matter. The first favourable opportunity he was impatient to try his experiment, and he sent his kite up into a thunder-cloud. The experiment succeeded beyond his hopes. The wire in the kite attracted the electricity from the cloud; it descended along the hempen string, and was received by an iron key attached to the extremity of the hempen string, that part which he held in his hand being of silk, in order that the electric fluid might stop when it reached the key. At this key he charged phials; with which phials, thus charged, he kindled spirits, and performed all the common electrical experiments.

Thus it is evident that the cause of those terrible convulsions of nature, which, in warm climates especially, are attended with such tremendous effects, is no other than a superfluous mass of electrical matter, collected in those immense watery conductors, the clouds; and that this matter is discharged when an electrical cloud meets with another which is less powerfully charged, or when it is brought sufficiently near the earth to be within the sphere of the electrical attraction. This fact may be proved at almost any time, but particularly in a sultry summer's evening, by repeating Dr. Franklin's experiment with the kite.

During a thunder storm the safest place is in the cellar; for when a person is below the surface of the earth, the lightning must strike it before it can reach him, and its force will therefore probably be expended on it. When it is not possible to retreat to the cellar, the best situation is in the middle of a room, not under a metal chandelier, or any other conducting surface; and it is advisable to sit on one chair, and to lay the feet up upon another; or it would be still better to lay two or three beds or mattresses one upon another in the middle of the room, and place the chairs upon them, the matters (viz. hair and feathers) with which they are stuffed being non-conductors. Persons in fields should prefer the open parts to any shelter under the trees, &c. The distance of a thunder cloud, and consequently the degree of danger, is not however difficult to be estimated. As light travels at the rate of seventy two thousand four hundred and twenty leagues in a second of time, its effects may be considered as instantaneous within any moderate distance; but sound, on the contrary, is transmitted only at the rate of three hundred and eighty yards in a second. By accurately observing the time, therefore, which intervenes between the flash and the noise of thunder which succeeds it, a very near calculation may be made of its distance.

The discovery of Dr. Franklin, which ascertained the identity of lightning and the electric fluid, suggested to the same philosopher the means of preserving buildings from lightning, by means of metallic conductors attached to the outside of high buildings. As these are now so common, it is unnecessary to describe them. The principle on which they are constructed is the well known fact of metallic bodies being better conductors of the

electrical fluid than any others. The conducting rod is pointed at the top, in order the more gradually to attract the electricity from the clouds and the atmosphere; and the upper part should be made of copper, to prevent its rusting, and the remainder should be painted. The conducting rod should not be too slender, and should extend in the earth beyond the building, to convey the electric matter clearly away; and if it terminates in a pool of water, which is one of the best conductors, it will be still safer.

Of Galvanism.

THIS surprising branch of philosophy has been denominated Galvanism, from Galvani, an Italian professor, whose experiments led to its discovery.

In 1789, some time before he made the most important discovery, he was by accident led to the fact, of electricity having the property of exciting contractions in the muscles of animals. Stimulated by the then prevailing idea of electricity being a principle inherent in animals, which, acting upon the muscular susceptibility, was the immediate cause of muscular motion, he was induced to persevere in the inquiry, during the prosecution of which he brought to light other facts, which laid the foundation of this valuable scientific acquisition.

After having observed that common electricity, even that of lightning, produced vivid convulsions in the limbs of recently killed animals, he ascertained that metallic substances, by mere contact, under particular circumstances, excited similar commotions.

He found, that it was essential that the forces of metals employed should be of different kinds. He applied one piece of metal to the nerve of the part, and the other to the muscle, and afterwards connected the metals, either by bringing them together, or by connecting them by an arch of a metallic substance; every time this connection was formed the convulsions took place. The diversity in the metals employed in these experiments appeared, in the very early stages of this inquiry, to be connected with their respective degrees of oxydability, the one being possessed of that property in a great degree, and the other little liable to the change. Hence zinc, and silver or gold, was found to produce the greatest muscular contractions.

The experiments of Galvani were confirmed by many able philosophers, by whom they were repeated. Those who particularly distinguished themselves by their labours on the subject were, Valli, Volta, Drs. Monro and Fowler.

As silver and zinc had been found in the minor experiments to produce the greatest effect, these metals were employed by Volta in the construction of his battery. The silver plates generally consisted of coins; and the zinc plates were of the same size, being frequently cast in moulds made with the silver. The same number of pieces of cloth, pasteboard, or leather, of the same size, and steeped in solution of common salt, were also provided. The above substances were formed into a pile, in the following order, zinc, silver, wet cloth, zinc, silver, wet cloth; and so on, in the same order, till the pile became sufficiently high. If it were to be elevated to any considerable height, it was usual to support it on the sides with three pillars of glass, or varnished wood.

The pile, thus formed, was found to unite the effects of as many pairs of plates as might be employed. Previously to this no other effect had been produced than what resulted from the energy of a single pair of plates. A pile of 50 pairs of plates, with as many corresponding pieces of wet cloth, was found to give a pretty smart shock, similar to an electric shock, every time that a communication was made between the top and bottom of the pile. It was found, however, that little or no shock was perceived, when the hands, or other parts applied, were not previously moistened. It was also observed, that the effect was increased when a larger surface was exposed to the action of the pile. If the communication were made by touching the pile with the tip of each finger merely, the effect was not perceived beyond the joint of the knuckle; but if a spoon, or other metallic substance, were grasped in moistened hands, the effect was felt up to the shoulder. If the communication be formed between any part of the face, particularly near the eyes, and another part of the body, a vivid flash of light is perceived before the eyes, corresponding with the shock. This phenomenon may be more faintly observed, by placing a piece of silver, as a shilling, between the upper lip and the gum, and laying a piece of zinc at the same time upon the tongue; upon bringing the two metals in contact, a faint flash of light is perceived. It is singular,

that this light is equally vivid in the dark with the strongest light, and whether the eyes be shut or open.

The most striking and the most common experiments are those which consist in the galvanic energy upon the organs of animals. If two metallic rods, or, what is equally convenient, two silver spoons, be grasped, one in each hand, the skin of the part being previously moistened with a solution of salt, and one of the spoons be brought in contact with one end of the battery, the moment the other comes in contact with the other end of the battery, the shock is perceived. Fifty compound plates will give a shock which will be felt in the elbows; one of a hundred will be felt in the shoulders; a greater number of plates give so forcible a shock to the muscles, as to be dreaded a second time. The shock appears to depend upon the number of plates. The stun, or first impression, is much the same, whatever may be the size of the plates; at least, from the size of two inches square to that of ten; the surfaces being as four to one hundred. The effect upon the muscles, as well as upon the cuticle itself, is very different from large plates, when the series is the same. It appears, that the shock, or first impression, is as the series, which is also as the intensity of the electricity. If the shock be received from the same number of large plates, the same species of commotion is produced in the first instance, as with the small plates; but if the contact be still kept up, a continuation of the effect is perceived, which is felt through the whole arms, producing a vast tremor, attended with a sensation of warmth. If the plates be from eight to twelve inches square, this effect may be perpetually kept, while the acids in the cells is expended.

Though small plates have been recommended for medical purposes, we think large ones will be found more likely to have a good effect. If the medical advantage is derived from the stimulus of galvanism, the effect of a perpetual and regular current of that stimulus must certainly be preferable to the rapid transmission of a small quantity.

The galvanic shock may also be conveniently given, by immersing the hands or the feet into vessels containing a solution of salt, and bringing wires from each end of the battery into the liquid. If any other part of the body is intended to be operated upon, a sponge moistened with

salt water, fastened to a metal plate connected with one end of the battery, may be applied to the part, and a hand or foot put into a vessel of the same liquid, connected by a wire with the other end of the battery. Small bits of sponge, or bits of leather, may be fastened to the end of the connecting wires, and made more or less moist, as the delicacy of the part may require. This contrivance is very useful in operating upon the eyes or ears.

When galvanism is used medically, it should first be applied very feebly, and the effect gradually increased, as the susceptibility of the part will admit. If the part has, from disease, become so languid and insusceptible, as not to be sensible of the effect, it should be scarified, or by other means have the cuticle removed. This is sometimes the case with languid tumours, and some cases of paralysis. Though we had no great opinion of the medical agency of galvanism, we have lately heard of several very successful cases; one of which, in particular, was the cure of perfect loss of speech. If the naked metal of the wire, from a powerful battery, be applied to the skin, it becomes cauterized and blistered.

If the plate, covered with a moistened sponge, connected with one end of the battery, be applied to the back of the head, at the same time that the moistened fingers of one hand are slightly applied to the other end, a smarting sensation will be felt in the part, and a taste at the same time will be felt in the mouth, similar, but in a greater degree, to that occasioned by the piece of zinc, and the shilling, when laid upon the tongue. This experiment succeeds the best with a small number of large plates, as much as ten inches square.

CHAP. VII.

GEOMETRY.

GEOMETRY is the science of extension, and is employed in the consideration of lines, surfaces, and solids; as all extension is distinguished into length, breadth, and thickness.

This science had its rise among the Egyptians, who were in a manner compelled to invent it, to remedy the confusion which generally happened in their lands, from the overflowing of the river Nile, which carried away all boundaries, and effaced all the limits of their possessions. And thus this invention, which at first consisted only in measuring the lands, that every one might have what belonged to him, was called land-measuring, or geometry. But the Egyptians afterwards applied themselves to more subtle researches, and, from a very mechanical exercise, insensibly produced this fine science, which deserves to be placed among those of the first rank.

Geometry is not barely useful, but even absolutely necessary. It is by the help of geometry that astronomers make their observations; regulate the duration of times, seasons, years, and cycles; and measure the distance, motion, and magnitudes of the heavenly bodies.

It is by geometry that geographers shew us the magnitude of the whole earth, delineate the extent of seas, and the divisions of empires, kingdoms, and provinces.

It is from this science that architects derive their just measures in the construction of public edifices, as well as of private houses.

It is by its assistance that engineers conduct all their works, take the situations and plans of towns, the distance of places, and, in fine, the measure of such things as are only accessible to the sight.

Such as are in the military service are obliged to apply themselves to this science. It is not only an introduction to fortification (which shews them how to build ramparts for the defence of places, and to construct and make machines to destroy them), but also gives them great knowledge and readiness in the military art, in the drawing up an army in order of battle, and in marking out the ground in encampments. It also shews them how to make maps of countries; to take the plans of towns, forts, and castles; to measure all kinds of dimensions, accessible or inaccessible; to give designs; and, in fine, to render themselves as serviceable by their understanding and science, as by their strength and courage.

All who profess designing should know something of geometry, because they cannot otherwise perfectly understand architecture or perspective, which are two things absolutely necessary in their art.

Music, mechanics, and, in a word, all the sciences which consider things susceptible of more and less, *i. e.* all the precise and accurate sciences, may be referred to geometry; for all speculative truths consisting only in the relations of things, and in the relations between those relations, they may be all referred to lines. Consequences may be drawn from them; and these consequences, again, being rendered sensible by lines, they become permanent objects, constantly exposed to a rigorous attention and examination. And thus we have infinite opportunities, both of inquiring into their certainty, and pursuing them further.

The reason, for instance, why we know so distinctly, and mark so precisely, the concords called *octave*, *fifth*, *fourth*, *&c.* is, that we have learnt to express sounds by lines, *i. e.* by chords accurately divided; and that we know that the chord which sounds octave is double of that which it makes octave withal; that the fifth is in the sesquialterate ratio, or as three to two; and so of the rest.

The ear itself cannot judge of sounds with such precision; its judgments are too faint, vague, and variable, to form a science. The finest, best tuned ear cannot distinguish many of the differences of sound; whence many musicians deny any such differences; as making their sense their judge. Some, for instance, admit no difference between an octave and three ditones; and others none between the greater and lesser tone: the comma, which is the real difference, is insensible to them; and much more the schisma, which is only half the comma.

It is only by reason, then, that we learn, that the length of the chord which makes the difference between certain sounds being divisible into several parts, there may be a great number of different sounds contained therein, useful in music, which yet the ear cannot distinguish. Whence it follows, that, had it not been for arithmetic and geometry, we had had no such thing as regular, fixed music; and that we could only have succeeded in that art by good luck, or force of imagination; *i. e.* music would not have been a science founded on incontestible demonstration; though we allow that the tunes composed by force of genius and imagination are usually more agreeable to the ear than those composed by rule.

So, in mechanics, the heaviness of a weight, and the distance of the center of that weight from the fulcrum, or point it is sustained by, being susceptible of plus and minus, they may both be expressed by lines; whence geometry becomes applicable hereto; in virtue thereof, infinite discoveries have been made, of the utmost use in life.

Geometrical lines and figures are not only proper to represent to the imagination the relations between magnitudes, or between things susceptible of more and less, as spaces, times, weights, motions, &c.; but they may even represent things which the mind can no otherwise conceive, *e. g.* the relations of incommensurable magnitudes.

We do not, however, pretend, that all subjects men may have occasion to inquire into, can be expressed by lines. There are many not reducible to any such rule: thus, the knowledge of an infinitely powerful, infinitely just God, on whom all things depend, and who would have all his creatures execute his orders, to become capable of being happy, is the principle of all morality, from which a thousand undeniable consequences may be drawn, and yet neither the principle nor the consequences can be expressed by lines or figures.

Indeed, the ancient Egyptians, we read, used to express all their philosophical and theological notions by geometrical lines. In their researches into the reason of things, they observed that God and nature affect perpendiculars, parallels, circles, triangles, squares, and harmonical proportions; which engaged the priests and philosophers to represent the Divine and natural operations by such figures; in which they were followed by Pythagoras, Plato, &c.

But it must be observed, that this use of geometry among the ancients was not strictly scientifical, as among us; but rather symbolical. They did not argue, or reduce things and properties unknown from lines; but represented or delineated things that were known. In effect, they were not used as means or instruments of discovering, but images or characters to preserve or communicate the discoveries made.

DEFINITIONS.

OF A POINT.

A point is that which has no parts; that is, it has no length, breadth, nor thickness. But as no operation can be performed without the assistance of visible and corporeal things, we must therefore represent the mathematical point by the natural one, which is an object of our sight, the smallest and least sensible, and is made by the prick of a pen or pencil; as the point marked A.

A *central point*, or center, is a point from whence a circle, or circumference, is described; or, rather, it is the middle of a figure.

A *secant point* is a point through which lines cross each other, and is usually called a section.

OF LINES.

A *line* is a length without breadth.

The line is nothing more than the passage made by a point from one place to another, and would be imperceptible, were it not described by the natural point, which by its course represents it to us.

There are many sorts of lines, as the point is susceptible of different movements.

A *right line* is that which is equally comprised between its two extremities; or, it is that which a point describes in its passage directly from one place to another, without any turnings; as AB.

A *curve line* is that which departs from a direct opposition to its extremities, by one or more turnings or windings; as CD.

When this line is described by the compasses, it is called circular

A *mixed line* is that which is both right and curve.

The *line* receives several other denominations, according to its various positions and properties.

A *perpendicular* is a right line which falls upon or is raised from another, making the angles on each side of it equal; as AB.

A *plummet line* is that which descends directly downwards, without inclining either to the right or left, and which, were it infinitely prolonged, would pass through the center of the world.

The *horizontal* is a line in equilibrium, or that inclines equally in all its parts; as DE.

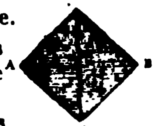
Parallel lines are those which are opposite each other, and at equal distances; as H.

An *oblique* is a line which is neither horizontal nor a plummet, but slanting or across; as FG.

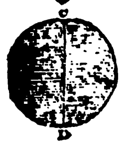
The *base* is the line upon which any figure rests.

Sides are the lines which inclose any figure.

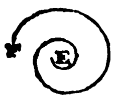
A *diagonal* is a right line which crosses any figure to two opposite angles of the same figure; as AB.



A *diameter* is a right line which crosses any figure through its center, and is terminated by its circumference; as CD.



A *spiral line* is a curve line which departs from its center, and the farther, in proportion as it turns round itself; as EF.

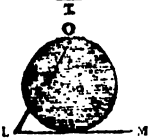


A *chord,* or *subtence,* is a right line extended from one end of an arch to the other end thereof; as GH.

An *arch* is part of a circle or circumference; as GIH.

A *tangent line* is that which touches some figure without passing into it, and without being able to pass into it or cross it, even though it were prolonged; as LM.

A *secant* is a line drawn from the center of a circle, cutting it, and meeting with a tangent without; as LO.



If two lines meet at their extremities, they either meet directly or indirectly. If directly, they then make but one line; if indirectly, they constitute an angle.

OF ANGLES.

An *angle* is the indirect course of two lines to the same point; or, rather, it is the space contained between the indirect course of two lines to the same point.

When this course is described by two right lines, the angle is called rectilinear; and when it is described by two curve lines, it is called curvilinear; but when it is described by two lines, one of which is a right and the other a curve, it is called mixtilinear.

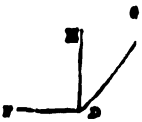
The rectilinear angle, according as it is more or less open, receives particular denominations, as right, acute, obtuse: therefore the terms rectilinear, curvilinear, and mixtilinear, have regard only to the nature of the lines; and those of right, acute, and obtuse, respect only the quantity of space contained between the said lines.

A *right angle* is when one of its lines is perpendicular upon the other; as EDF.

An *acute angle* is that which is less open than the right; as EDG.

An *obtuse angle* is that which is more open than the right; as FDG.

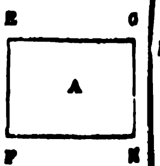
The letter D in the middle shews the angle.



DEFINITION OF SUPERFICIES.

A *superficies* is that which has length and breadth, without thickness.

According to geometricians, as the line is a production of the point, so the superficies is a production of the line. Thus, supposing the line EF was from each of its extremities drawn to GH, it constitutes the superficies EF, GH, which is an extent between lines, that has length and breadth, but not depth or thickness; and this is frequently called a *surface*: or if it is considered with regard to its extremities, which are the lines by which it is encompassed, it is then called a *figure*.



If a superficies is raised, it is a called *convex*; if it is hollow, it is called *concave*; and if it is flat and even, it is called a *plane*.

The termination is the bounds or limits of any thing.—The point is the termination of the line; the line is the termination of the superfices; and the superfices is the termination of a body.

Of Rectilinear Superfices or Figures.

Superfices have particular names according to the number of their sides.

A *trigon*, or *triangle*, is a figure of three sides.

A *tetragon*, or *square*, figure of four sides.

A *pentagon*, figure of five sides.

A *hexagon*, figure of six sides.

An *heptagon*, figure of seven sides.

An *octagon*, figure of eight sides.

A *nonagon*, figure of nine sides.

A *decagon*, figure of ten sides.

An *undecagon*, figure of eleven sides.

A *duodecagon*, figure of twelve sides.

All these figures are also called by the general name of *polygons*.

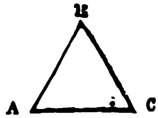
OF TRIANGLES.

The fewest number of right lines that can include a space, are three, which form a figure called a *triangle*, or three-cornered figure, consisting of six parts, viz. three

sides and three angles. Triangles are distinguished by th nature of their angles, and the disposition of their sides, i the following manner.

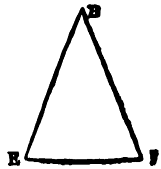
I.

An *Equilateral Triangle* is that in which the three sides, or lines are equal, as ABC.



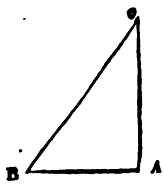
II.

An *Isosceles Triangle* is that which has only two equal sides, as BEF.



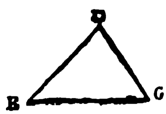
III.

A right-angled Triangle has one of its angles right; the side opposite the right angle is called the hypotenuse, and the other two sides are called legs; that which stands upright is called the perpendicular, and the other the base: thus BC is the hypotenuse, AC the perpendicular, and AB the base; the angles opposite the two legs are both acute.



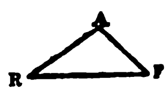
IV.

An *Acute-angled Triangle* has all its angles acute, or none of them equal to a right angle, as DEG.



V.

An *Obtuse-angled Triangle* has one of its angles obtuse, or greater than a right angle, as RAF; the other two angles are acute.



All triangles, that are not right angled, whether the are acute or obtuse, are in general terms called obliqu angled triangles, without any other distinction.

Of Figures of Four Sides.

A

a *square*, a figure of four equal
nd four right angles.

B

Long-square, a rectangled super-
which has its angles right, but not
equal.

C

Rhumbus, or a quadrilateral figure,
four sides are equal, but not its
gles.

D

Rhomboides, whose opposite sides
gles are equal, though the figure is
equiangular nor equilateral.

re also *Parallelograms*, which are quadrilateral
whose opposite sides are parallel

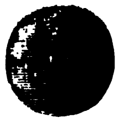
apezium is a figure, two of whose sides only are pa-
e two others equal.

apeziod, one whose sides and angles are unequal.

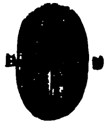
her figures of more than four sides are called by
ral name of *multilaterals*.

Of Curves, or Curvilinear Figures.

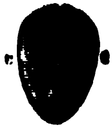
A. is a *circle*, which is a superficies or figure perfectly round, described from a centre whose circumference is equally distant from it. The circumference is the extremity of the circle, or the line which incloses it.



B. an *Oval*, which is a curvilinear figure described from several centers, and all whose diameters divide equally in two.



C. an *Ellipsis*, which is also a curvilinear figure described from several centers, but in the form of an egg, and of which there is but one diameter that divides it equally in two



Of Mixed Figures.

A semicircle is so much of a circle as is contained from its diameter either way.

A sector is a figure composed of two semidiameters, with more or less than half of the circle.

Concentric figures are those whose centers are the same.

Excentric figures are those contained in some measure within each other, but which have not the same center.

Of Regular and Irregular Figures.

A regular figure, is that whose opposite sides are equal and the same.

An irregular figure, is that composed of unequal sides and angles.

Similar figures are those of which the lines of one are proportioned to the lines of the other, though one may be greater or lesser than the other.

Equal figures are those whose centers are the same, and which may be similar or dissimilar.

An equiangular figure has all its angles equal.

One figure is equiangular to another, when all the angles of one are equal to all the angles of the other.

An equilateral figure is that whose sides are all equal.

Similar curvilinear figures are those in which may be inscribed, or round, which may be circumscribed, similar polygons.

Axioms.

An *axiom* is such a common, plain, self-evident, and received notion, that it cannot be made more plain and evident by demonstration, because it is itself better known than any thing that can be brought to prove it.

1. Things equal to one single thing, are in themselves equal.

2. If equal things are added to things that are equal, the whole will be equal.

3. If equal things are taken from things that are equal, the remainder will be equal.

4. If equal things are added to things that are unequal, the whole will be unequal.

5. If equal things are taken away from things which are unequal, the remainder will be unequal.

6. Things which are double the proportion of another, are in themselves equal.

7. Things which have but half the proportion of other equal things, are in themselves equal.

We have thus given the outline of this useful science, but its principles may be best known by an attentive study of the Elements of Euclid. This most renowned of mathematicians was born at Alexandria, in Egypt, where he taught his favourite science with great reputation in the reign of Ptolemy Lagos, about 280 years before Christ.— He reduced to order the fundamental principles of pure mathematics, which had been delivered down by Thales, Pythagoras, and Eudoxus, and added many others of his

wn, on which account, to him is attributed the honour of reducing arithmetic and geometry to the form of sciences.

CHAP. VIII.

GEOGRAPHY AND ASTRONOMY.

THE science of geography chiefly consists in a description of the surface of the terrestrial globe, which is naturally composed of two parts, land and water, and is therefore called the terraqueous globe. Each of these elements are sub-divided into various parts, and are distinguished by different names, viz. the earth into continents, islands, peninsulas, isthmus's, and promontories or capes; the waters into oceans, seas, straits, bays or gulphs, lakes, and rivers.

The terrestrial globe is 360 degrees in circumference, every degree being 60 geographical miles; so that the whole circuit is 21600 such miles; and if the diameter was a third part of the circumference, the diameter would be 7200 miles; but the diameter is as 7 to 22, which makes it something less than a third part of the circumference. If we reduce the geographical miles to English miles, the circumference of the earth will be about 24000 miles, and the diameter 8000.

The terrestrial globe rests upon nothing, but appears equally surrounded by the heavens on every side; for the better understanding whereof, it will be necessary to observe the several imaginary circles described on the artificial globe, viz. 1. The equator, and the circles parallel to it.—2. The first meridian, and the rest of the meridional lines.—3. The zodiac, which includes the ecliptic.—4. The horizon.—5. The two tropics. 6. The arctic and antarctic circles. It is supposed also, that a line passes through the center of the globe, called its axis, round which it moves every 24 hours, the ends of which axis are called the poles of the earth, that in the north called the arctic or north pole, from a star in the heavens opposite to it, which

forms part of the constellation called the *Little Bear*, and that in the south called the antarctic or south pole, as diametrically opposite to the other.

By the equator the globe is divided into two equal parts or hemispheres, and on this circle are marked the degrees of longitude, from the first meridian, either east or west. The parallel circles are so called from their running parallel to the equator, of which there are nine in number inclusive between the equator and either pole, ten degrees distant from each other, every degree of latitude being 60 geographical miles, and every ten degrees 600 such miles. Consequently it is 5400 miles from the equator to either pole, which is one quarter of the circumference of the globe.

The first meridian is represented by the brazen circle in which the globe moves, dividing it into the eastern and western hemispheres, on which circle are marked the degrees of latitude, which are counted northward from the equator to the north pole, and southward from the equator to the south pole.

Where the meridional lines are 24 in number, they are 15 degrees, or one hour asunder; those who live under the meridian line on the right hand, that is, to the eastward of the first meridian, have the sun an hour before us; and those who live under the meridional line on the left hand, that is, west of us, have the sun an hour after us; and this shews what is meant by eastern and western longitude. And as longitude is nothing more than the distance any place is east or west of the first meridian, so latitude is the distance a place is from the equator north or south. If it be north of the equator, it is called north latitude; and if it be south of the equator, it is called south latitude.

The first meridian in the old maps was placed either at Teneriff, one of the Canary Isles, 17 degrees west of London, or at Ferro, another of the Canary Isles, 19 degrees west of London. But every nation almost at this day places the first meridian at their respective capitol cities in their several maps. In English maps London is made the first meridian. And in English maps the upper end is always the north, the lower end the south; the right hand east, and the left hand west; the degrees of longitude being marked at the top and bottom of each map, and the degrees of latitude on the sides of the map.

The zodiac is that circle which cuts the equator obliquely, and is divided into twelve signs, through which the sun seems to pass within the space of 12 months, each sign containing 30 degrees of longitude.

The ecliptic is a line passing through the middle of the zodiac, and shews the sun's, or rather the earth's path or orbit, in which it moves annually.

The horizon is the broad circle in which the globe stands, dividing it into the upper and lower hemispheres. The place where any one stands, is the center of this horizon and hemisphere; the sensible horizon seems to touch the surface of the earth, and is the utmost limits of our sight, upon an extensive plain. The rational horizon is supposed parallel to this, and to be extended to the heavens.

The poles of our horizon are two imaginary points in the heavens, called the *zenith* and *nadir*; the *zenith* being the vertical point directly over our heads, and the *nadir* that point of the heavens under our feet, diametrically opposite to the *zenith*.

As the earth turns round upon its own axis every 24 hours, which makes day and night, that part of the heavens which was over our heads at 12 at noon must of course be under our feet at 12 at night; but, speaking properly, no part of the earth can be said to be uppermost or lowermost. All the inhabitants of the earth seem to have the earth under their feet, and the heavens over their heads, and ships sail with their bottoms to each other.

The tropics shew how far the sun, or rather the earth, proceeds north or south of the equator every year. The tropic of *Cancer* surrounds the globe 23½ degrees north of the equator, and the tropic of *Capricorn* 23½ south of the equator.

The polar circles are drawn 23½ degrees distant from each pole, and 66½ distant from the equator.

The earth is divided into five zones, viz. the torrid zone, the two frigid zones, and the two temperate zones, and are denominated zones, because they encompass the earth like a girdle.

The torrid zone lies between the two tropics, and is so denominated from the excessive heat of the climate, the sun passing over it twice every year.

The two frigid zones lie within the polar circles, and are so called from the excessive cold within those circles.

The northern temperate zone lies between the tropic of *Cancer* and the arctic circle; and the southern temperate zone, between the tropic of *Capricorn* and the antarctic circle.

What is generally understood by the elevation of the pole, is the height of the pole above the horizon, and is always equal to the latitude of any place, as the south of England lies in 50 degrees of north latitude, so the north pole must of course be elevated 50 degrees above the horizon there; for which reason, the latitude of a place, and the elevation of the pole, are used promiscuously to express the same thing.

The brazen horary circle, fixed on every globe with an index, shews how many hours, and consequently how many degrees, any place is east or west of another place; for as every 15 degrees east or west is an hour, so every hour is 15 degrees.

The quadrant of altitude is a pliant brass plate divided into 90 degrees, one fourth of the circumference of the globe, by which the distances of places may be found, and many useful problems resolved.

The inhabitants of the earth are distinguished in regard to their respective situations, and are denominated either Periæci, Antæci, or Antipodes.

The Periæci are situate under the same parallel, but opposite meridians: It is midnight with one when it is noon with the other, but the length of their days and their seasons are the same; these are found, by turning the horary index twelve hours, or turning the globe half round.

The Antæci are situate under the same meridian, but opposite parallels; these have the seasons opposite to ours, and the same length of days; but when their days are longest, ours are shortest. These are found by numbering as many degrees on the opposite side of the equator as we are on this.

The Antipodes lie under opposite meridians, and opposite parallels; these have different seasons, and their noonday is our midnight, and their longest day our shortest: These are found by turning the horary index 12 hours from the given place, or turning the globe half round, and then counting as many degrees on the opposite side of the equator as the given place is on this.

The inhabitants of the earth are also distinguished by their different shadows at noon day, and are denominated either Amphiscii, Ascii, Heteroscii, or Periscii.

The Amphiscii inhabit the torrid zone, and have their noon day shadows both north and south: When the sun is south of them, then their shadows are north, and when the sun is north of them, their shadows are south, these are also called Ascii, because the sun is vertical twice every year at noon day, and then they have no shadow.

The Heteroscii, who inhabit the temperate zones, have their shadows always one way at noon day. In the northern temperate zone their shadows are always north; and in the southern temperate zone, their shadows are always south at noon day.

The Periscii inhabit within the polar circles, and have their shadows every way, the sun being above their horizon all the 24 hours, several months in the year, viz. when it is on the same side of the equator they were of: and if there were any inhabitants at either of the poles, they would have but one day of six months, and one night of the same length.

Climates are spaces on the surface of the globe, bounded by imaginary circles parallel to the equator, so broad that the length of the day in one exceeds that of another half an hour, of which there are 60 in number, viz. 24 from the equator to each of the polar circles, and six from either of the polar circles to the respective poles, between which last, there is a difference of an entire month; the sun appearing in the first one month above the horizon without setting, in the second two months, and so on to the pole, where there is a day of six months, and the nights proportionable, when the sun is on the opposite side of the equator.

These climates are not of an equal breadth, those near the equator being much the broadest: For example, the first climate next the equator is eight degrees, odd minutes, in breadth, whereas the 11th climate is little more than two degrees broad.

The end of one climate is the beginning of the next.—At the first climate, which begins at the equator, the day is just 12 hours long at the beginning of the climate, and 12 hours 30 minutes at the end of it, viz. in 8 degrees 25 minutes of latitude, where the second climate begins.

Every degree of latitude contains 60 geographical miles.

Every degree of longitude counted on the equator, also is 60 geographical miles; but as the meridional lines approach nearer each other as you advance towards either pole, consequently the number of miles between those lines must lessen in proportion; as, for instance, a degree of longitude in 52 degrees of latitude contains but 37 miles, though it be full 60 miles upon the equator.

The inhabitants of the earth are sometimes distinguished according to the various positions of their horizon, as they are situate in a right sphere, a parallel sphere, or an oblique sphere.

In a right sphere the equator passes through the *zenith* and *nadir*, and the parallel circles fall perpendicularly on the horizon, which is the case of those people who live under the equinoctial line.

In a parallel sphere the poles are in the *zenith* and *nadir*; the equator is parallel to, and coincides with the horizon, and the parallel circles are parallel to the horizon, which can only be said of people under either pole.

In an oblique sphere the inhabitants have one of the poles above and the other under the horizon, and the equator and parallel circles cutting the horizon obliquely, as is the case of all people that do not live under the equinoctial line.

To rectify the globe, in order to find the true situation of any place.

Let the globe be set upon a level table, and the brazen meridian stand due north and south, then bring the given place to the brazen meridian, and let there be 90 degrees between that place and the horizon both north and south, and the given place will be in the *zenith*; the globe being thus rectified, you may proceed to solve any problem.

To find the longitude and latitude of a given place.

The longitude of any given place will be found by numbering on the equator so many degrees as the place lies east or west of the first meridian: And the latitude will be found by counting so many degrees on the brazen meridian as the place lies north or south of the equator.—

You must turn the globe, therefore, either east or west, till the given place is brought to the brazen meridian, and you will see the degree of longitude marked on the equator; and the latitude is found at the same time, only by numbering the degrees on the brazen meridian either north or south of the equator, till you come to the given place.

To find what places are under the same meridian with the given place.

Bring the given place to the brazen meridian, and observe what places lie under that meridian either north or south of the equator.

To find what places have the same latitude.

Turn the globe round, and observe on the brazen meridian what places come under the same degree of latitude as the given place is.

To find the sun's place in the eliptic at any time of the year.

When you know the month, and day of the month, you will find upon the wooden horizon the sign in which the sun is opposite to the day of the month, which is the sun's place in the ecliptic at that time.

To know the length of the days at any time, and at any place.

Bring the given place to the *zenith*; then bring the sun's place in the ecliptic to the east side of the horizon, and set the index of the hour circle to 12 at noon, or the upper figure of 12, and turn the globe till the said place in the ecliptic touch the western side of the horizon, and the number of hours between the upper figure of 12, and the hour the index points to, to shew how many hours the day is long, and consequently the length of the night; because so many hours as the day falls short of 24, must be the length of the night; as when the day is 16 hours long, the night must of course be 8 hours long.

To find those places on the globe where the sun is in the meridian at any time.

The globe being rectified, and the place where you are brought to the brazen meridian, set the index of the horary circle at the hour of the day at that place, then turn the globe till the index points to the upper 12, and you will see all those places where the sun is in the meridian; as for example, if it be 11 in the morning at London, and you set the index at 11, turn the globe till the index points at the upper 12, and you will find Naples, which is an hour or 15 degrees east of London: and in all places under the same meridian as Naples is, it must consequently be 12 at noon at that time.

In like manner, if it be 4 in the afternoon at London, and you set the index at 4, and turn the globe till the index points at the upper 12, you will find Barbadoes, which is four hours or 60 degrees west of London; and at all places under the same meridian as Barbadoes is, it must consequently be 12 at noon at that time.

To find where the sun is vertical at any time of the year.

The sun can only be vertical in such places as lie between the tropics; and, to know this, you are only to find what place the sun is in the ecliptic, and bringing that place to the brazen meridian, observe what degree of latitude it has; for in all places in that latitude the sun will be vertical that day, and you will find all those places only by turning the globe round, and observing them as they come to the brazen meridian.

To find where the sun is above the horizon, or shines without setting all the 24 hours, in the northern hemisphere.

The day given must be when the sun is in the northern signs, and, having found the sun's place in the ecliptic, you must bring that place to the brazen meridian; then count the same number of degrees from the north pole towards the equator, as there is between the equator and the sun's place in the ecliptic; then turn the globe round; and in all the places passing under the last degree counted from the north pole, the sun begins to shine constantly without setting on the given day: and the rule will serve

vice versa for any place set in the southern hemisphere, when the sun is in the northern signs.

To find the length of the longest and shortest days and nights at any place in the northern hemisphere.

Rectify the globe according to the latitude of the given place, or, which is the same thing, bring the given place to the *zenith*, then bring the first degree of *Cancer* to the east side of the horizon, and setting the index of the hour circle to the upper figure of 12, turn the globe till the sign of *Cancer* touch the west side of the horizon, and observe the number of hours between the upper figure of 12 and the hour the index points to, and that is the length of the longest day, and the shortest night consequently consists of so many hours as the day falls short of 24; and as for the length of the days and nights in the southern latitude, they are just the reverse of those in northern latitude.

To find in what place the sun is rising or setting, or in its meridian; or what parts of the earth are enlightened at any particular time.

First find where the sun is vertical at the given hour, and bring that place to the *zenith*, under the brazen meridian; then observe what places are in the eastern semicircle of the horizon, for there the sun is setting, and in those places in the western semicircle of the horizon the sun is rising, and in all places under the brazen meridian it is noon day: all those places in the upper hemisphere of the globe are enlightened, and those in the lower hemisphere are in darkness.

To find the distance of one place from another upon the globe.

If both places lie under the same meridian, bring them to the brazen meridian, and count thereon how many degrees of latitude the two places are from each other, which, being reduced to units, is the true distance: every degree of latitude containing 60 geographical miles, as has been observed already; and 60 geographical miles make near 70 English miles. If the two places lie under the same parallel of latitude, then observe on the equator

how many degrees of longitude they are asunder, and observe how many miles a degree of longitude makes in that latitude; and then numbering the degrees of longitude on the equator, reduce them to miles, and that will give the distance of the two places. For instance, suppose Rotterdam lies in 52 degrees of north latitude, and 4 degrees of eastern longitude, and Pyrmont lies under the same parallel 5 degrees east of Rotterdam, and I find that every degree of longitude in this latitude makes 37 miles, then I multiply 37 by 5, which makes 185, being the number of miles between Rotterdam and Pyrmont.

Where the two places differ both in longitude and latitude, the distance may be found by measuring the number of degrees they are asunder by the quadrant of altitude, and reducing those degrees to miles. For example, if we find the two places are the length of 10 degrees asunder by the quadrant, they must necessarily be 600 miles distant from each other; because 60 miles, which is the extent of 1 degree of latitude, multiplied by 10, makes 600 miles on the globe, in whatever direction one place lies from another, as the north, east, south, west, &c.

To find how one place bears of another: that is, whether it lies north-east, south-west, or on any other point of the compass from another place.

Bring one of the places to the *zenith*, and fix the quadrant of altitude there; then extend it to the other place whose bearing you would know, and the lower part of the quadrant will intersect the wooden horizon at the point of the compass inscribed on the wooden horizon, which is the true bearing of the given place.

To find on what point of the compass the sun rises or sets at any place.

Bring the given place to the *zenith*, and, having found the sun's place in the ecliptic, bring the same to the eastern side of the horizon, and it will shew on what point of the compass the sun rises. On the other hand, if you bring the sun's place in the ecliptic to the west side of the horizon, it will shew on what point of the compass the sun sets.

The world is divided into four quarters, viz. Europe, Asia, Africa, and America.

The population of the globe is computed at 953 millions. In Russia there are 17 inhabitants to each square mile; in Italy, 170; and in the Netherlands, 275. This great disproportion arises from the difference with respect to climate, agriculture, and commerce.

Europe, the most eminent part of the globe with respect to literature, arts, sciences, and commerce, is far the least in point of extent. It is about 3000 miles long, 2500 broad, and its area, according to Templeman's survey, is 258,000 miles.

It lies almost entirely in the northern temperate zone; a small part of it at the northern extremity is extended beyond the arctic circle, but it does not approach nearer to the equator than 35½ degrees. On the east and south-east, it is bounded by Asia; on the west, north-west, and south-west, by the Atlantic Ocean; and on the south, by the Mediterranean Sea. The number of inhabitants is computed to amount to 153 millions. It is the most populous of all the quarters of the globe, in proportion to its size, and enjoys the most uniform temperature of climate; the soil is well adapted to tillage or pasturage, yields a copious supply of the necessaries of life, and its mines produce the most useful metals. The character of the Europeans seems to partake the advantages of the climate, and is remarkable, particularly in the more northern parts, for the ingenuity, industry, and enterprising temper of the natives. The manufactures, particularly of the English and French, are conveyed to the most remote countries, and are found to contribute to the comfort of all nations. Owing to the influence of a mild and benevolent religion, the horrors of war are softened; and from the prevalence of commerce, a more general and more amicable intercourse is carried on than in any other part of the globe.

The principal divisions of Europe are as follow: England, Scotland, and Ireland, Spain, Portugal, France, Italy, the Austrian Netherlands, the United Provinces, Germany, Bohemia, Hungary, Transilvania, Sclavonia, Croatia, Turkey in Europe, Poland, Prussia, Russia, Sweden, Denmark, and Norway. The independent states are the United Kingdoms of Great-Britain and Ireland, France, Russia, the larger part of Germany, Prussia,

Sweden, and Denmark and Norway. All the other countries are either so much oppressed by the tyranny, or influenced by the councils, of the French government, that no observation can be made which it is hoped will continue applicable to their political condition.

The British dominions formerly included several provinces in France. They now comprehend England, Wales, Scotland, and Ireland; the Isles of Wight, Scilly, Man, Jersey, Guernsey, Alderney, and Sark; Gibraltar in Spain—Malta in the Mediterranean Sea—Jamaica, Barbadoes, St. Christopher's, Antigua, Nevis, Montserrat, Dominica, Martinico, St. Vincent, Grenada, &c. &c. in the West Indies—the island of St. Helena, settlements upon the coast of Africa, and extensive territories in the East Indies—the provinces of Nova Scotia, Canada, and New Britain, in North America; as well as Newfoundland, Cape Breton, St. John's, the Bermudas or Somer's Islands, and the Lucayos or Bahama Islands, upon the coast of North America. To these may be added the settlement of Botany Bay upon the coast of New Holland, and Norfolk Island in the South Pacific Ocean.

The extent of England is 320 miles from north to south, that is, from Berwick upon Tweed to the Isle of Wight; and 285 miles from east to west, that is, from the South Foreland, in Kent, to the Land's End, in Cornwall. It contains 40 counties, and 9,343,578 inhabitants.

Wales, divided into North and South, is 130 miles long, and 97 broad. It contains 12 counties, and about 300,000 inhabitants.

Scotland, exclusive of its numerous islands, is 270 miles long, from the Mull of Galloway, in the south, to Cape Wrath, in the north; and 140 miles from east to west, in the broadest part. It contains 13 shires north, and 18 shires south of the river Tay, and about one million and a half of inhabitants.

Ireland is 285 miles from north to south, and 180 from east to west, in the broadest part. It is divided into four provinces, and 32 counties, and contains about four millions of inhabitants.

England, Wales, Scotland, and Ireland, constituting the United Kingdom of England and Ireland, are represented in the Imperial Parliament by the following proportions of members: England and Wales send 513 members,

Scotland 45, Ireland 100, making the House of Commons amount in all to 658. Scotland sends twelve peers to the House of Lords, and Ireland thirty-two; but the English peers, who are members of that House, are unlimited.

Asia has been renowned in history from the beginning of time. There the all-wise Creator planted the Garden of Eden, and placed in it the first parents of the human race. After the deluge it became again the nursery of the world. There the sons of Noah dwelt, and colonies went forth to people the globe; there the Redeemer of mankind appeared, to preach the gospel of life and immortality. In Asia, the ancient monarchies of Assyria and of Persia were erected. It is much larger than either Europe or Africa; it is about 4800 miles in length, and 4800 in breadth, and contains an area of 8 millions of miles. Except China, and the greater part of Hindoostan, it is thinly inhabited. The population is computed to amount to five hundred millions. The soil is rich; and it produces corn in the greatest abundance, the most delicious fruits, plants, drugs, and gums; and in its mines are found diamonds, gold, silver, copper, and iron. The difference of climate, manners, and productions, is so strongly marked, that they cannot be included under one description. No objects which it presents are more interesting to us than the Chinese empire, and the British territories in Hindoostan.

Africa is separated from Europe by the Mediterranean Sea, and is united to Asia by the isthmus of Suez. It is much larger than Europe, but less than either Asia or America. It is not broken, like Europe and the south of Asia, into several irregular tracts of land by the interposition of the sea, but has the appearance of an uniform and vast peninsula. The once populous and commercial coast of the Mediterranean, formerly the seat of the powerful empire of Carthage, now contains only the small piratical states of Barbary. A very large portion of Africa lies between the tropics, and is exposed to excessive heat. This is the part which produces most gold and aromatic drugs, and where lions, tigers, and elephants abound. The inhabitants are either tawny Moors, or negroes of different shades and features. The interior of Africa is no otherwise known than from the accounts of a few travellers, or the vague reports of the tribes that live near the coasts.

America, or the New World, is between eight and nine thousand miles in length, and in some parts nearly 3690 miles in breadth; it enjoys all the variety of climates, and occupies a considerable part of both hemispheres, and is not much inferior in dimensions to a third part of the habitable globe. The eastern shores are washed by the Atlantic and Southern Oceans, and the western by the Pacific Ocean. It consists of two great continents, distinguished by the names of North and South America. These are connected by the isthmus of Darien, nearly 360 miles in length, but not more than 16 miles broad in the narrowest part. In the gulph bounded by the northern and southern continents, lie numerous islands, which are called the West Indies, to distinguish them from the countries on the eastern coasts of Asia, which are called the East Indies.

North America is divided into the provinces of Nova Scotia, Canada, and New Britain, belonging to Great Britain; the sixteen United States, Louisiana, lately purchased by them of the French; East and West Florida, California, and Mexico, or New Spain, belonging to Spain. The immense inland country, much of which is unexplored, is still occupied in many parts by the Indian tribes.

The colonies of South America, still more extensive, remain in the possession of their parent countries of Spain and Portugal; while these states, notwithstanding the vast revenues which they derive from their colonies, have been long sinking in the scale of European importance. South America is divided into seven great provinces: Terra Firma, Peru, Amazonia, Brazil, Paraguay, Chili, and Patagonia. Peru, the richest province of America, situated on the southern coast, is about 1400 miles long, and 400 broad. Its chief commodities are gold and silver, quicksilver, pearls, cotton, tobacco, cochineal, and drugs; quinquina, or the Jesuit's bark, the virtue of which is well known all over Europe, and tobacco of the finest flavour, are peculiar to this country. The climate of Brazil is temperate, and the soil fertile; its chief commodities are gold, diamonds, red wood, sugar, amber, &c. It is subject to the king of Portugal, who draws great riches from it.

The foregoing is a very imperfect account of the terraqueous globe we inhabit. It is so large in dimensions, that Teneriffe or Mont Blanc are, compared to it, but as

grains of dust upon an artificial sphere. Its diameter is 7970 miles, and its surface contains 199,557,250 square miles.

Maps, Charts, &c.—It is by longitude and latitude the situation of places is determined and described by the moderns. A true map of the world can only be delineated on a globe or ball. Maps, however, are projected, upon different principles, on plane surfaces. If a large space be described on one of these, it must necessarily be represented in a distorted manner; but the distortion, however, is regular, and any small part of the map in tolerable proportion with itself, though not with the whole.

The ancients, in their scanty knowledge of geography, and before their invention of the manner of reckoning by the degrees of longitude and latitude, contented themselves with mentioning the climate as the situation of a place.

Astronomers mark the stars of every constellation on the celestial charts and globes with the letters of the Greek alphabet, denoting those that are most conspicuous by α, and calling them of the first magnitude; the next by β, calling them of the second magnitude; and so on, in succession, to stars of the fifth and sixth magnitude.

Geographers sometimes place the compass in a vacant part of a map, to shew the bearings of the different places on it, the *fleur de lis* always pointing towards the north; but, in maps of general geography, the top is usually the north; the degrees of latitude are marked on the sides, and the degrees of longitude, or the difference of time, along the top and bottom. If the figures along the sides increase upwards, the country delineated is in north latitude; if downwards, it is in south latitude; if the figures along the top and bottom increase from right to left, it is in western longitude; if from left to right, it is in eastern longitude. The scales in maps are for measuring distances. Towns and cities are represented by a church, house, castle, or other building, by a small circle; or, if fortified, by an indented circle or oval. Roads are expressed by double lines running close and parallel between towns or cities, and sometimes by single ones, the figures along them telling the distance. Rivers are represented by black lines, small near their source, and growing stronger to the sea. Mountains are sketched on a map

as on a landscape. Forests and woods appear like little bushes. Deserts are represented by small dots. Bogs or morasses, and savannahs, are made out by shades of parallel lines; and lakes are represented by a darker shade. The dotted lines and party-colours in maps serve to distinguish one country from another; and the line which represents the shore is strong and shaded, or rather lightened off into the water.

In topographical maps, or delineations of small or partial tracks of country, there is not so much attention paid to having the north to the top; and the same remark applies to sea charts.

In sea charts the land is often almost blank, while the channels, soundings, rocks, backs, sands, &c. are distinctly marked; and the shading of the coast is the reverse of what it is in maps. The meridians are often drawn in straight and parallel lines; and the lines of latitude are also straight parallels crossing the meridians at right angles. This is called Mercator's projection. The points of the compass are also frequently repeated, and extended through the whole chart, to shew the magnetic points, or the variation of the compass. The direction of winds, tides, and currents, is commonly denoted by arrows. Banks, sands, and shallows, are represented by small dots. Rocks are represented by small crosses, or sometimes by marks representing the points of rocks. Small anchors denote anchorage; and figures express the soundings in fathoms.

ASTRONOMY.

THIS science is, of all others, the most sublime, the most beautiful, and the most interesting; for there are no persons, of whatever age, to whom the heavenly bodies are not objects of curiosity. The certain principles upon which it rests, are proved by the calculations of eclipses; as the astronomer can determine not only that the luminaries of day and night will be darkened, but he can pronounce with certainty at what particular point of time, and to what particular extent, such obscurations will hap-

pen, and exactly how long they will continue. Some parts of astronomy are so useful to mankind, as to make the cultivation of it highly necessary: accordingly we may find traces of it among all nations. By its assistance, geographers are enabled to ascertain the true figure and size of the earth, and the situation and extent of countries; chronologists can compute the measure of the year; and navigators can determine the longitude of places, and direct their courses through the trackless and stormy ocean, with correctness and safety. This science opens to our view the solar system and fixed stars.

Of the Solar System.

THE solar system which the moderns have adopted, was taught by Pythagoras, revived by Copernicus, confirmed by Galileo, Kepler, and Descartes, and fully established by Sir Isaac Newton. The sun is placed in the centre of this system, from which it never moves; but from observations made upon its spots, it is found to turn round its own axis, from west to east, in about twenty five days. The planets, called primary, revolve round the sun at unequal distances: their names are *Mercury*, *Venus*, the *Earth*, *Mars*, *Jupiter*, *Saturn*, and the *Georgium Sidus*, and they move in the order in which they are here mentioned.

The two planets *Ceres* and *Pallas*, lately discovered by Piazzi and Olbers, two foreign astronomers, may be referred to the solar system, but their orbits have not yet been determined with precision.

To this system belong other spherical bodies, which move round their respective primary planets in the same manner as the primary planets move round the sun, from the west to east; except those of the Georgium Sidus, which appear to move in a contrary direction. These are called secondary planets, satellites, or moons. The most conspicuous is the moon, which moves round the earth in something less than twenty eight days: *four* revolve round Jupiter, *seven* round Saturn, and *six* round the Georgium Sidus.

A TABLE OF THE SOLAR SYSTEM.

	Mean diameters in English miles.	Mean distances from the Sun.	Daily rotation round their axes	Time of revolving round the Sun.
			D. H. M.	D. H. M.
The Sun - -	883,246	. . . .	25 14 8	
Mercury - -	3,224	37 Millions of miles.	Unknown	87 23 10
Venus - - -	7,687	68	0 23 21	224 16 49
The Earth - -	7,911	95	1 0 0	365 5 48
The Moon - -	2,180	95	29 17 44	. . . . . .
Mars - - -	4,189	144	0 24 40	686 23 30½
Jupiter - - -	89,170	490	0 9 56	4332 14 27
Saturn - - -	79,042	900	0 10 16	10759 1 51
Georgium Sidus	35,112	1800	Unknown	30737 18 0

It is important to remark the distance of the primary planets from the sun, and of the secondary planets from their primaries, and the times of their revolutions; because we are hence led to see more clearly the excellence of the Copernican system, according to which the motions of all the planets are regulated by one general law, viz. the squares of the periodical times of the planets are to each other as the cubes of their mean distances from the sun; and the same law is established with respect to the secondaries in revolving round their primaries.

The planets are retained in their orbits by the united operation of the *centripetal* force, by which a body is attracted to the centre of gravity, and the *centrifugal* force, by which it endeavours to persevere in a straight line. These two powers, mutually balancing each other, like action and re-action, retain the planets in their orbits, and compel them to make their respective revolutions.

The mean distance of the moon from the earth is about thirty of the earth's diameters, or 240,000 miles. The surface of the moon is to that of the earth nearly as 1 to 13⅓, and their respective quantities of matter nearly as 1 to 39. The sun is about a million of times bigger than the earth.

The planets, both primary and secondary, are opaque bodies, and receive all their light from the sun, and make their revolutions round it. From the appearance of the bounds of light and shadow upon their surface, they are concluded to be spherical, which is confirmed by many of them being found to turn periodically on their axis.

The planet Jupiter is surrounded by thin substances, called *belts*, in which there appear so many changes, that

they are generally thought to be clouds, for some of them have appeared broken, and then have become entirely invisible.—Saturn is surrounded by a thin broad ring, which appears double through a good telescope. There is reason to believe that it turns round its axis; because, when its edge only is visible to us, it appears somewhat thicker on one side of the planet than on the other; and the thickest edge has been seen on different sides at different times.

Each of the primary planets moves round the sun in a curve line, which forms an ellipsis. The sun is placed in one of the foci. The point of the line in which the planet approaches nearest to the sun is called the *perihelion*; the point at which it is most remote, is called the *aphelion*. Its mean distance is equal to half the sum of its greatest and least distance from the focus in which the sun is placed.

Comets.

COMETS are supposed to be solid opaque bodies of various magnitudes, with long transparent tails resembling a pale flame, and issuing from the part of the comet furthest from the sun. They move round the sun in very elliptic orbits, and cross the orbits of the planets in all directions. From the curved direction of their paths, Newton concludes, that when they disappear they go much beyond the orbit of Jupiter; and that, in their perihelion, they frequently descend within the orbits of Mars and the inferior planets. He computed the heat of the comet which appeared in 1680, when nearest the sun, to be 2000 times hotter than red hot iron, and that it must retain its heat until it comes round again, even if its period should be more than 20,000 years, and it is computed to be only 575.

Of the Fixed Stars.

No part of the universe affords such exalted ideas of the structure and magnificence of the heavens, as the consideration of the number, magnitude, nature, and distance of the fixed stars. We admire indeed, with propriety, the vast bulk of our own globe; but, when we consider how much it is surpassed by most of the heavenly bodies, what a point it degenerates into, and how

little more even the vast orbit in which it revolves would appear, when seen from some of the fixed stars, we begin to conceive more just ideas of the extent of the universe, and of the infinity of creation.

The fixed stars comprehend all the celestial objects, excepting the sun, the moon, and the planets, and some comets which now and then appear.

The stars, on account of their apparently various magnitudes, have been distributed into various classes and orders. Those which appear largest, are called *stars of the first magnitude*: the next to them in lustre, *stars of the second magnitude*; and so on to the sixth, which are the smallest that are visible to the bare eye. This distribution having been made long before the invention of telescopes, the stars which cannot be seen without the assistance of those instruments, are distinguished by the name of *telescopic stars.*

They are likewise distinguished, with regard to their situations, into *asterisms*, or *constellations*; which are nothing but assemblages of several neighbouring stars, considered as constituting some determinate figure, as of an animal, &c. from which it is therefore denominated.

The number of constellations in the northern hemisphere is 36; in the southern 32; and in the ecliptic 12. Those stars which are not included in the constellations, are called unformed stars; those clusters of stars which are so distant as not to be distinctly seen, are, from their cloudy appearance, comprised under the name of *nebulæ*; and that light-coloured irregular circle or band which encompasses the heavens, and is distinguishable from the ethereal blue by its brilliancy; that shining zone, which owes its splendour to the innumerable stars of which it is formed, and which passes through many of the constellations in its ample range, is called the *galaxy*, the *via lactea*, or the *milky way*.

The idea of classing the stars under well known forms, probably originated with the Egyptian shepherds, who, during the silent watches of the night (as they slept in the open air) had no other objects to contemplate than those which the starry heavens presented; among these, assisted by the powers of a fertile imagination, they discovered a distant resemblance of such things as they were most familiar with. The shepherds thus conceiving the figure of things in the firmament, the poets embellished the illusion with

the fictions of mythology, till the heavens were, as it were, filled with these imaginary creatures, and these were increased in after-ages, and served astronomers in their accounts of the starry heavens, as the present divisions of the earth help geographers in the description of the globe.

The twelve constellations which surround the ecliptic, commonly called the twelve signs of the zodiac, are the following:—*Aries*, the Ram; *Taurus*, the Bull; *Gemini*, the Twins; *Cancer*, the Crab; *Leo*, the Lion; *Virgo*, the Virgin; *Libra*, the Balance; *Scorpio*, the Scorpion; *Sagittarius*, the Archer; *Capricornus*, the Goat; *Equarius*, the Water-bearer; and *Pisces*, the Fishes; and they are noted on globes, &c. in the following manner:

Aries.	*Taurus.*	*Gemini.*	*Cancer.*	*Leo.*	*Virgo.*
♈	♉	♊	♋	♌	♍
Libra.	*Scorpio.*	*Sagittarius.*	*Capricornus.*	*Aquarius.*	*Pisces.*
♎	♏	♐	♑	♒	♓

The former six are called northern, and the latter southern signs; because the former possess that half of the ecliptic which lies to the northward of the equinoctial; and the latter that which lies to the southward. The northern are our summer signs, the southern our winter ones.

As these twelve signs answer to the twelve months in the year, it is a very probable conjecture that the figures under which they are represented are descriptive of the seasons of the year, or months, in the sun's path; thus, the first sign Aries, denotes, that, about the time when the sun enters into that part of the ecliptic, the lambs begin to follow the sheep; that on the sun's approach to the second constellation, Taurus the Bull, is about the time of the cows bringing forth their young. The third sign, now Gemini, was originally two kids, and signified the time of the goats bringing forth their young, which are usually two at a birth, while the former, the sheep and cow, commonly produce only one. The fourth sign, Cancer, the Crab, an animal that goes side-ways and backwards, was placed at the northern solstice, the point where the sun begins to return back again from the north to the southward. The fifth sign, Leo, the Lion, as being a very furious animal, was thought to denote the heat and fury of the burning sun, when he has left Cancer, and entered the next sign Leo. The succeeding constellation, the sixth in order, re-

ceived the sun at the time of ripening corn and approaching harvest; which was aptly expressed by one of the female reapers, with an ear of corn in her hand, viz. Virgo, the Maid. The ancients gave to the next sign, Scorpio, two of the twelve divisions of the zodiac; autumn, which affords fruits in great abundance, affords the means and causes of diseases, and the succeeding time is the most unhealthy of the year, expressed by this venemous animal, here spreading out his long claws into one sign, as threatening mischief, and in the other brandishing his tail to denote the completion of it. The fall of the leaf was the season of the ancient hunting; for which reason the stars which marked the sun's place at this season, into the constellation Sagittary, a huntsman with his arrows and his club, the weapons of destruction for the large creatures he pursued. The reason of the Wild Goat's being chosen to mark the southern solstice, when the sun has attained his extreme limit that way, and begins to return and mount again to the northward, is obvious enough; the character of that animal being, that it is mostly climbing, and ascending some mountain as it browses. There yet remains two signs of the zodiac to be considered with regard to their origin, viz. Aquarius and Pisces. As to the former, it is to be considered that the winter is a wet and uncomfortable season; this, therefore, was expressed by Aquarius, the figure of a man pouring out water from an urn. The last of the zodiacal constellations was Pisces, a couple of fishes tied together, that had been caught; the lesson was, The severe season is over; your flocks do not yield their store, but the seas and rivers are open, and there you may take fish in abundance.

With respect to the distances of the fixed stars, they are so extremely remote, that we have no distances in the planetary system to compare to them.

The distance of the star Draconis (a star of the fifth magnitude) appears, by Dr. Bradley's observations, to be at least 400,000 times that of the sun, and the distance of the nearest fixed star not less than 40,000 diameters of the earth's annual orbit; that is, the distance from the earth, of the former at least 38,000,000,000,000 miles, and the latter not less than 7,600,000,000,000 miles. As these distances are immensely great, it may both be amusing, and help to a clearer and more familiar idea, to compare

them with the velocity of some moving body, by which they may be measured.

The swiftest motion we know of, is that of light, which passes from the sun to the earth in about eight minutes; and yet this would be above six years traversing the first space, and near a year and a quarter in passing from the nearest fixed star to the earth. But a cannon-ball, moving on a medium at the rate of about twenty miles in a minute, would be 3,800,000 years in passing from Draconis to the earth, and 760,000 years passing from the nearest fixed star. Sound, which moves at the rate of about thirteen miles in a minute, would be 5,000,000 years traversing the former distance, and 1,128,000 in passing through the latter. The celebrated Huygens pursued speculations of this kind so far, as to believe it not impossible, that there may be stars at such inconceivable distances, that their light has not yet reached the earth since the creation.

Though the number of the stars appears to be immensely great, yet have astronomers long since ascertained the number of such as are visible to the eye, which are much fewer than at first sight be imagined. Of the 3000 contained in Flamstead's catalogue, there are many that are only visible through a telescope; and a good eye scarcely ever sees more than a thousand at the same time in the clearest heaven; the appearance of innumerable more, that are frequent in clear winter nights, arising from our sight being deceived by their twinkling, and from our viewing them confusedly, and not reducing them to any order.- But a good telescope directed indifferently to almost any point of the heavens, discovers multitudes that are lost to the naked eye; particularly in the milky way. And F. de Rheita affirms, that he has observed above 2000 stars in the single constellation of Orion. The same author found above 188 in the Pleiades. Galileo found eighty in the space of the belt of Orion's sword, twenty one in the nebulous star of his head, and above 500 in another part of him, within the compass of one or two degrees of space, and more than forty in the nebulous star Præsepe, and the recent discoveries of Dr. Herschel have proved the fixed stars to be immense, their regions unbounded, and perhaps infinite!

As the stars, contrary to the moon and planets, shine like our sun, by their own native light, astronomers suppose that each of them is a sun with its system of inhabit-

ed worlds revolving round it. Under this idea or persuasion, of how innumerable a family do we seem to make a part! The immensity of the universe becomes peopled with fellow beings, and we feel an interest at what appears to be going on at distances so vast, that what we see, as in time present, we have reason to believe (swift, inconceivably swift, as is the progress of light, darting from the spheres) must have happened many ages ago. Under the idea of the universe being replenished with human beings, how magnificent, how awful, are the spectacles that present themselves to the observer of the heavens! The creature of a day, of a few fleeting moments, seem to obtain a glimpse of a new creation, a glimpse of the end of time in the passing away of a system.

What an amazing conception, if human imagination can conceive it, does this give of the works of the Creator!—Thousands of thousands of suns, multiplied without end, and ranged all around us, at immense distances from each other, attended by ten thousand times ten thousand worlds, all hung loose, as it were, in boundless space, upheld by nothing, confined by nothing—yet preserved in their rapid course, calm, regular, and harmonious, invariably keeping the paths assigned them by the sovereign Artificer.

Let these grand objects! these amazing systems! their numbers, motions, magnitudes, which are much too vast and too sublime for the capacity of the human mind to form an adequate conception of, raise and kindle in the heart love, praise, and adoration to the supreme and great Creator.

"I will consider thy heavens, even the works of thy fingers, the moon and the stars which thou hast ordained. What is man that thou art mindful of him, and the son of man that thou visitest him? O Lord, our governor, how excellent is thy name in all the world!"

CHAP. IX.

HISTORY AND CHRONOLOGY.

HISTORY, in the general sense of the word, signifies *a true relation of facts and events*; or, considered in a moral point of view, it is that lively philosophy, which, laying aside the formality of rules, supplies the place of experience, and teaches us to act with propriety and honour according to the examples of others. The province of history is so extensive, that it is connected with every branch of knowledge; and so various and abundant are its stores, that all arts, sciences, and professions, are indebted to it for many of the materials and principles upon which they depend. It opens the widest prospect to the eyes of mankind in the spacious fields of literature, and is one of the most pleasing and important objects of study to which the mind can be directed.

If the limited acquaintance we have in the world, the objects that surround us within so small an extent, and some minute transactions of present times, furnish matter of inquiry and amusement, and are sufficient to excite our curiosity, how much greater delight may we reasonably propose to ourselves in extending the bounds of this knowledge, by taking a view of the pursuits, employments, and inclinations of men of all ages and conditions; by travelling into distant nations, traversing the vast regions of the universe, and carrying our researches back through the long series of ages which have succeeded one another since the creation of the world? These great advantages may be attained by the study of history. It lays open to us all countries, times, and transactions, and makes us in a manner an eye witness to the astonishing changes and revolutions that have from time to time happened in the world. By perusing the records of past ages, we carry ourselves back to the first original of things, and enter upon a new kind of existence. We see the world rising

out of nothing, behold how it was governed in its infancy, how overflowed and destroyed in a deluge of water, and again re-peopled. We trace the first institution and establishment of kingdoms and commonwealths, observe how they rose, flourished, and decayed, and enter into a kind of intimacy and correspondence with the several great men who contributed to these mighty revolutions. And here it is chiefly that, by taking a view of the actions and behaviour of those that have gone before us, and examining into their atchievements, virtues, and faults, the mind comes to be furnished with prudent maxims and reflections, and is enabled to form wise and unerring rules for the conduct of life, both in a private and public capacity.

It is history, then, that best teaches what is honourable and becoming in all the various stations of life, and how a man may acquit himself with dignity, if fortune smiles upon him, and recommends him to places of credit and power, so will it give the truest insight into the instability of human things, and thereby prepare us for those revolutions and changes which in the course of life may happen. For, when we look back into the annals of past ages, we see not only particular men and families experience these alterations, but even mighty kingdoms and potent empires have undergone the same fate. Greece and Rome, heretofore famous for their invincible armies, renowned commanders, and the extent of their dominions, are now brought to a level with other nations, yea sunk to the most abject state of slavery. The arts and sciences, that flourished in so eminent a degree among them, and spread their reputation so far, are in a great measure dispersed in other countries, and have contributed to raise them out of the obscurity in which they were long involved. And, if great and powerful states are not exempt from these changes, well may we expect them in the fortunes of particular men. And how useful must that study be, which not only teaches us to acquit ourselves well upon any sudden elevation or success, but also arms us against the adverse accidents of life, so that no reverse of fortune shall be able to break the harmony of our minds? For here we meet with many examples of men, who, after supporting public stations with honour, have shone out no less illustrious in private life; others, again, sinking suddenly from riches to poverty, have by their behaviour added a dig-

nity to their low and depressed condition. These are the models which history lays before you; and by following these you will make yourselves great, wise, and esteemed, in every sphere of life. If called to public employments, you will know how to fill them with lustre; and, being well apprised of the instability of human affairs, will not suffer any attachments to grow upon you, that by a reverse of fortune might destroy the balance within. A mind rightly constituted is not intoxicated with prosperity; but, still looking forward, and foreseeing the possibility of a change, disposes itself to submit without murmuring or regret.

By history, also, without hazard to ourselves, we are made wise by the experience of others. We see the passions of mankind, their interfering interests, and all the artifices by which they impose upon each other. We are taught to be upon our guard against flattery, to shun the contagion of vice, to disclaim all commerce with the dissolute and abandoned, and associate only with the wise and good.

History, considered with respect to the nature of its subjects, may be divided into *general* and *particular*; and with respect to time, into *ancient* and *modern*. Ancient history commences with the creation of the world, and is by Bossuet, the learned author of an universal history, extended to the reign of Charlemagne, Emperor of Germany and France, in the year of our Lord 800. Modern history beginning with that period reaches down to the present time. General history relates to nations and public affairs, and may be subdivided into *sacred*, *ecclesiastical*, and *profane*.

But as history is a recital of past events and occurrences that have been carried on in different countries, and in a series of ages, the one succeeding the other, in order to reap the fruits of it in their full extent and maturity, it will be necessary to have some previous knowledge of the succession of times, and of the several nations and kingdoms where these transactions took place. For it so happens, that the revolutions of one age often give rise to, and are strictly connected with those of another. And therefore we can form but very confused notions of the rise and fall of empires, and the establishment of states, without some such general comprehension of the whole

current of time as may enable us to trace out distinctly the dependence of events, and distribute them into those periods and divisions that shall lay the whole chain of past transactions in a just and orderly manner before us. This is that part of knowledge which the learned distinguish by the name of *chronology*; importing a discourse concerning time.

We shall not enter into the nice speculations of philosophers in the definitions they have endeavoured to give us of time, as tending rather to perplex than illustrate the matter. Let it suffice to observe, that the idea of it seems to arise from the reflection of our own minds, when, in turning our thoughts upon the general course of things, we consider some as present, some as past, and some as to come. For here consideration is had of various periods, not co-existent, but following one another in succession; and the interval between any two of these periods is what we properly call a space of time. The general idea thus explained, it will be easy to trace its different shapes and modifications. For in taking account of things past, they appear to the mind either as existing together, or as distant from one another by various intervals. And when these intervals come to be compared, some of them appearing longer than others, and these longer being considered as double or triple the shorter, hence we get the notion of measuring one portion of time by another, than which nothing can tend more to render our ideas of it clear and distinct. For when any extent of time is too large for the mind to take in at once, by thus considering it as a composition of some lesser space, and equal to a certain repetition of it, the idea is ascertained, and passes in a distinct review of all its parts before us. But, then, when we come to apply these measures to time, either as running on in continual succession, or as already past and gone, we find ourselves lost in an immeasurable depth, and meet with nothing to bound us either way. This makes it necessary to fix upon some determinate point, or points, in this infinite duration, from which, as from a beginning, the various measures of time, as *days*, *months*, *years*, &c. may be numbered either backwards or forwards. And accordingly several roots or terms of this kind have been devised by different nations, as they happened to think one thing or another more worthy of rememberance,

and therefore fit to give a date to other transactions.—They are called *epochas*, or *æras*, as being a kind of resting place for the mind, from which to look about it, and begin its computations.

Now, from what has been said, it will readily be perceived, that the whole science of chronology may be fitly divided into two parts or branches; one comprehending the knowledge of the various measures and periods by which time is computed; and the other describing the several æras and epochas, from which, according to different nations, events are dated. For, by knowing these two, we are masters of the whole current of time, as being not only able to calculate the length of any interval or distance, but also, by comparing the computation of various ages and kingdoms, to fit them one to another, and, by adjusting the whole to some standard period, regulate the intire succession of past transactions.

As the idea of time in general is acquired by considering the parts of duration as existing in succession, and distant from one another by several intervals; so the idea of any particular time, or length of duration, as a day, a month, a year, &c. is obtained by observing certain appearances uniformly returning at regular and seemingly equidistant periods. For thus we get the notion of equal spaces, and, by variously multiplying and combining these, can form to ourselves different measures of time, of different lengths, according to the exigency of things. Now the motions of the sun, and other heavenly bodies, by reason of their constancy and equability, easily invited men to make them the standard by which to regulate these several dimensions. And because the apparent diurnal revolution of the sun was not only constant and equable, but frequent and of a shorter circuit; hence it naturally became the first measure of time, under the denomination of a day.

A *day*, therefore, may be defined to be a division of time, drawn from the appearance and disappearance of the sun, and is of two kinds, artificial and natural.

The *artificial day*, which seems to be that primarily meant by the word day, is the time of light, or of the sun's stay above the horizon, determined by his rising and setting: In opposition to which, the time of darkness, or of the sun's continuance below the horizon, from setting to rising again, is called night.

The *natural*, or, as it is also called, the *civil day*, is that space of time wherein the sun compleats his circuit round the earth; or, to speak properly and astronomically, the time of an entire revolution of the equator. Different nations have acted with great diversity of choice, in fixing the beginning of their days; some computing from the rising, others from the setting of the sun, and others again from his passing the upper or lower meridian. Hence the ancient Babylonians, Persians, Syrians, and most other eastern nations, with the present inhabitants of the Balearick Islands, the Greeks, &c. begin their day with the sun's rising. The ancient Athenians and Jews, with the Austrians, Bohemians, Marcomanni, Silesians, modern Italians, and Chinese, reckon from the sun's setting. The ancient Umbri and Arabians, with the modern astronomers, from noon. And the Egyptians and Romans, with the modern English, French, Dutch, Germans, Spaniards, and Portuguese, from midnight. And as different people thus varied as to the time of beginning the day, so were their different distributions and divisions of it into parts; some distinguishing the time of the artificial day into twelve equal portions, which therefore in different seasons of the year must be of different lengths. But the distinction that now most generally prevails, is that of the whole space of day and night into twenty four hours, which, being so well known will need no farther illustration.

All the periods and distinctions of time we meet with in chronology are no other than various combinations of this first measure, accommodated to the particular wants of mankind, the different appearances of the heavens, and the several intervals of past transactions. Men were, no doubt, in the beginning, contented with the simple revolution of a day, and for some little time it would well enough serve all the purposes expected from it. But as the world advanced in age, and the intervals between the different transactions became large and extended, the number of days would multiply so fast, as soon to discover the necessity of instituting more comprehensive measures of time, for the easy and convenient computation of these longer spaces. This was done by combining days into various systems and classes of different lengths, according to the exigency of things, which gave rise to the institution of *months*, *years*, *olympiads*, &c.

Different nations have adopted different modes of computing time. The most ancient we read of is that of Moses. In his description of the deluge he calculates by months, consisting each of thirty days, and by years, consisting of 360 days each. According to Herodotus, the Egyptians reckoned in the same manner, and from them probably Moses adopted his method, as he was versed in all their learning.

The Greeks calculated by Olympiads. An *Olympiad* is a space of four years, after the expiration of which, that is in the fifth year, games in honour of Jupiter Olympus was celebrated with great pomp and festivity by the Greeks near Olympia, a city in Peloponnesus. They were fully established in the 3228th year of the world, 776 before Christ. This mode of computation appears to have ceased after the 364th, which ended A. D. 440, as we have no further mention of them in history.

The usual mode of Romish computation was from the years which had elapsed from the building of the city, *anno urbis conditæ*, expressed briefly by the letters A.U.C. This event took place in the 3250th year of the world, and the 750th year before Christ.

The ordinary mode of reckoning the years of the world is to take 4004 before Christ for the æra of the creation, which is adopted from the Hebrew text of the scriptures. Christians compute from the most memorable of all æras, the birth of our Saviour, which happened in the 27th year of the reign of Augustus, and in the year of Rome 749. The Turks compute from the *Hegira*, or flight of Mahomet from Mecca; this happened in the 622d year of our Lord, when Heraclius was emperor of the East. The Julian, or old stile, is so called from Julius Cæsar, who regulated the Roman calendar. He added a day immediately after the twenty fourth of February, called by the Romans the sixth of the calends of March; as it was thus reckoned *twice*, the year in which it was introduced was called *Bissextile*, or what we call Leap Year.

This calendar was still more reformed by order of Pope Gregory XIII. in 1582, from whence arose the new stile, which is now observed in every European country, except Russia. The Julian year was too long by nearly eleven minutes, which excess amounts to three days in 400 years.

the Pope, therefore, with the advice of able astronomers, ordained that a day in every three centuries out of four should be omitted; so that every century, which would otherwise be a bissextile year, is made to be only a common year, excepting only such centuries as are exactly divisible by four, which happens once in four centuries.—This reformation of the calendar commenced in the countries under the papal influence on the 4th of October, 1582, when ten days were omitted at once, which had been overrun since the Council of Nice in 325, by the overplus of eleven minutes each year. In England, this new style commenced only in 1752, when eleven days were omitted at once, the 3d of September being reckoned the 14th in that year; as the surplus minutes had then amounted to eleven days. The calendar thus reformed, which, by an act of parliament in the 24th of Geo. II. was ordered to be observed, comes very nearly to the accuracy of nature, for it is ordered by that act, that Easter Sunday, on which the rest of the feasts depend, is always the first Sunday after the full moon, which happens upon, or next after the 21st of March; and if the full moon happens on a Sunday, Easterday is the Sunday after.

After these observations on chronology, we shall, consonant to our design, hasten to lay before the reader a short view of ancient history from the creation of the world to the birth of Christ, dividing that whole interval into ten parts. The first takes in the duration of the old world, or from the creation to the deluge, which includes one thousand six hundred and fifty-six years. The second reaches from the deluge to the vocation of Abraham, and takes in four hundred and twenty-six years. The third, from the vocation of Abraham to the departure of the children of Israel out of Egypt, comprehends four hundred and thirty years. The fourth, from the departure out of Egypt to the destruction of Troy, includes three hundred and eight years. The fifth, from the destruction of Troy to the laying the foundation of the temple under Solomon, takes in an hundred and seventy-two years.—The sixth, from the foundation of the temple to the building of Rome, includes two hundred and fifty-eight years. The seventh, from the building of Rome to Cyrus, comprehends two hundred and eight years. The eighth, from Cyrus to the overthrow of the Persian Empire by Alexan

der the Great, contains two hundred and six years.—The ninth, from the fall of the Persian Empire to the defeat of Perseus, when Rome became the mistress of the world, takes in an hundred and sixty-two years. The tenth, and last, from the destruction of the kingdom of Macedon under Perseus, to the beginning of the Christian æra, includes about an hundred and sixty-eight years.

The first epocha opens with a display of Almighty power. God creates the world out of nothing, and pours upon it a profusion of ornaments, that it may be an agreeable habitation for man, who stands in the first rank of beings here below. This great event is placed by Archbishop Usher, whose chronology we choose to follow, in the 710th year of the Julian period, and the 4004th before Christ. Here Moses, the great lawgiver of the Jews, begins his history, and presents us with the original pair in a state of innocence and perfection, adorned with the image of their maker, and exercising dominion over the creatures. This is the period so much celebrated by the poets under the name of the golden age. But, alas! it was of short continuance. Eve seduced, and Adam joining in offence, experience a fatal reverse of fortune, and are forced to quit the delightful abode of Paradise.

Years of the World.

130 The earth begins to be peopled, and the corruption of human nature discovers itself.—Abel is murdered by his brother Cain; but punishment follows close upon the offence.—We see the criminal suffering under the reproaches of his own conscience, and retiring from the commerce of men, whose hatred he had justly incurred.—By him the first city is built, and among his posterity we meet with the first beginning of arts. Here we see, at the same time, the tyranny of the human passions, and the prodigious malignity of the heart of man. The

987 posterity of Seth withstand the general torrent, and continue faithful to God. Enoch is miraculously taken up into heaven, as a reward for his upright walking with his Maker. The posterity of Seth intermarrying with the descendents of Cain; or, in the language of scripture, the sons of God going in unto the daughters of men, an universal corruption ensued. God, no longer able to bear with the wickedness of men, resolves upon

their destruction, and makes known his purpose
by the mouth of his servant Noah; but they conti- 1536
nuing hardened in their iniquities, the earth is co-
vered with a deluge of water, and all mankind cut off,
Noah and his family excepted. This happened in the
1656th year of the world, and the 2366th of the
Julian period. It is worth observing, that, as the 1656
deluge was universal, so the tradition of it has ob-
tained amongst all nations. Nothing is more celebrated in the writings of the poets, nor can any event of equal antiquity boast of so many concurring testimonies to support it. Not that sacred history derives any additional strength from such foreign recommendations; but the mind is pleased to see truths, in which it takes a real interest, confirmed by the annals of nations who had not any such motives to engage their belief of them.

Second epocha.—The Deluge.

To the times following after the deluge, we must refer to some considerable changes in the ordinary course of nature. So universal a shock doubtless caused great alterations in the atmosphere, which now took a form not
so friendly to the frame and texture of the human
body. Hence the abridgement of the life of man, 1756
and that formidable train of diseases which have
ever since made such havoc in the world. The memory of the three sons of Noah, the first founders of nations, has, we find, been preserved among the several people descended from them. Japhet, who peopled the greatest part of the west, continued long famous under the celebrated name of Japetus. Ham was revered as a God by the Egyptians under the title of Jupiter Hammon. And the me-
mory of Shem has ever been held in honour among
the Hebrews, his descendents. The first consider- 1757
able dispersion of mankind was occasioned by the
confusion of languages, sent among them by God, upon their engaging in a vain attempt of building a tower, whose top might reach the heaven. As the earth, after the deluge, was over-run with woods, which became the haunts of wild beasts, the great heroism of those times consisted

in clearing the ground, and extirpating these savage monsters, that held mankind under continual alarms, and hindered them from enlarging their habitations. Nimrod, acquiring great reputation in this way, is thence called by Moses a mighty hunter before the Lord. As his enterprizes of this kind soon made him considerable, and naturally tended to rouse ambition in the heart of man, we find him aiming at dominion over his fellow creatures, and establishing his authority upon conquest. Such was the first beginning of kingdoms. Nimrod founded his
1771 at Babylon, where the vain attempt to build the famous tower had been made. Much about the same time the foundations of Ninevah were laid, and several other ancient kingdoms established. They were but of small extent in their first beginning, as is easy to suppose. In Egypt alone we meet with four dynasties or principalities; Thebes, Thin, Memphis, and Tanis. To this age, also, we may refer the origin of the Egyptian laws and policy. Already they began to distinguish themselves by their astronomical knowledge, which was also cultivated with no less ardour among the Chaldeans. You will readily suppose, that if the speculative sciences began by this time to be cultivated, those practical arts that tend to the ease and accommodations of human life would not lie neglected. Noah had doubtless preserved all the inventions of the old world; but, as the face of nature was considerably altered by the deluge, new contrivances must be adapted to their present circumstances. Hence agriculture, architecture, and the art of polishing mankind, are found to have flourished very early in the western parts of the world, where Noah and his descendents first settled. In proportion as we remove from them, we meet with nothing but barbarity and a savage wilderness. Even Greece itself, which led the way in arts and sciences to the other European nations, was wholly unacquainted with the most necessary concerns of human life, till strangers arriving from the Eastern countries, brought along with them the knowledge of those more improved nations.—But, though arts and sciences thus flourished in the east, the knowledge of the true God seems to have decayed very early. Tradition introduced many absurd notions into religion, and made way for those gross ideas of the Deity that soon overspread the world. The number of

false divinities multiplied exceedingly; and this was what gave occasion to the vocation of Abraham.

Third epocha.—The Vocation of Abraham.

This happened about four hundred and twenty-six years
after the deluge, and in the 2793d year of the Julian period.
For then it was that the several nations of the earth,
walking after their own ways, and forgetting him
that made them; God, to hinder in some measure 2083
the progress of this universal depravation, resolved
to separate for himself a chosen people. Abraham was
called to be the father of this distinguished race. God
appeared to him in the land of Canaan, where he purposed
to establish his worship, and the posterity of that eminent
patriarch, whom he promised to multiply as the
stars of heaven, and the sand upon the sea shore. 2092
It is remarkable of this father of the chosen nation,
that though abounding in wealth, and possessed of a power
which had proved an over-match for that of several
kings united, he yet adhered to the manners of ancient
times, and, contented with the simplicity of a pastoral life,
discovered his magnificence no otherwise than by the
most unbounded and extensive hospitality. It was
in his time that Inachus, the most ancient of all the 2148
kings mentioned in the history of Greece, founded
the kingdom of Argos. After Abraham, we read of
Isaac, his son, and Jacob his grandson, who no less distinguished
themselves by a simplicity of manners and steady
faith in God. Nor did they miss of the reward due to
their piety. The same promises were renewed to them,
and they equally experienced the favour and protection of
heaven. Isaac blessed Jacob, to the prejudice of his elder
brother Esau, and, though deceived in appearance,
only fulfilled the council of God. Esau 2245
is also mentioned in scripture by the name of Edom,
and was the father of the Idumeans, of no small note in
history. To Jacob were born the twelve patriarchs, fathers
of the twelve tribes of Israel. Among them Joseph
holds a distinguished place. The train of accidents by
which he became first minister to the king of Egypt,
plainly speaks the immediate interposition of Providence,

which was then preparing for the accomplishment of the promises made to Abraham. For to this was owing the settlement of Jacob's family in that part of Egypt of which Tanis was the capital, and where the kings took all the name of Pharaoh. Jacob, a little before his death,
2315 calling his children together, made that celebrated prophetic declaration of the future state of their posterity, in which he particularly discovered to Judah the time of the Messiah, and that he was to issue from his loins. The family of this patriarch became in a short time a great people, insomuch that the jealousy of the Egyptians being roused by so amazing an increase,
2433 they began to lay them under heavy oppressions. At length God sends Moses into the world, delivers him from the waters of the Nile, and makes him fall into the hands of Pharaoh's daughter, who educates him as her own son, and instructs him in all the learning of the Egyptians. About this time the people of Egypt sent out colonies into several parts of Greece. That of
2448 Cecrops founded twelve cities, or rather villages, in Attica, of which was composed the kingdom of Athens, where the Egyptian laws and religion were introduced by the founder. Not long after happened that famous flood in Thessaly, under Deucalion, which the Greek poets have confounded with the universal deluge. Hellen, a son of this Deucalion, reigned afterwards in Thessaly, and gave his name to Greece. Much about the same time, Cadmus, the son of Agenor, came with a colony of Phœnicians into Bœotia, and founded the ancient city of Thebes. Moses, in the mean time, advanced in years, and, being driven from the court of Pharaoh, because he opposed the persecution of his brethren, fled into Arabia, where he fed the flocks of his father in law, Jethro, forty years. It was here that he saw the vision of the burning bush, and heard the voice of God cal-
2513 ling to him to go to deliver his brethren from the slavery of Egypt. He obeyed the divine admonition, and wrought all those wonders in the court of Pharaoh, of which we have so full an account in holy writ.—And this brings us to the 4th period of our history.

Fourth Epocha.—The Departure out of Egypt.

In the 850th year after the deluge, the 430th from the vocation of Abraham, and the 3223d of the Julian period, Moses led the children of Israel out of Egypt, and received the law from God himself upon Mount Sinai. In his progress through the wilderness to the Land of
Canaan, he instituted, by God's appointment and 2513
direction, the whole tabernacle service. We find
him also establishing a form of civil government among the tribes, in the framing of which he was assisted by the counsel of his father-in-law Jethro. During these transactions in the wilderness, the Egyptians continued sending out colonies into divers nations, particularly Greece,
where Danaus found means to get possession of the 2530
throne of Argos, driving out the ancient kings de-
scended of Inachus. Upon the death of Moses, 2553
Joshua succeeded, who began and nearly complet-
ed the conquest of Canaan. After him we meet with a succession of Judges. Unhappily the Israelites, after the death of the elders that knew Joshua, forgot the God of their fathers, and were seduced into the idolatry of the bordering nations. This drew down heavy chastisements from above, and they were sold into the hands of cruel oppressors. But when, in their distress, they called upon God, he failed not, from time to time, to raise up
a deliverer. Thus Othniel put an end to the ty- 2599
ranny of Cushan, king of Mesopotamia, and 80
years after Ehud delivered them from the oppres- 2679
sion of Eglon, king of Moab. Much about this
time Pelops, the Phrygian, the son of Tantalus, reigned in Peloponnesus, and gave his name to that famous Peninsula. Bel, or Belus, king of the Chaldeans, received from his people divine honours. The Jews, enslaved or victorious, according as they honoured or forsook their God, experience many vicissitudes of fortune, as may be seen in the histories of Deborah and Barak, of Gideon, Abimelech, Jephthah, &c. This age is considerable for many great revolutions among the heathen nations. For, ac-
cording to the computation of Herodotus, who
seems the most exact and worthy of credit, we are 2737
here to fix the foundation of the Assyrian empire
under Ninus the son of Belus, 520 years before the building of Rome, and in the time of Deborah the prophetess.

He established the seat of it at Ninevah, that ancient city, already famous over all the east, but now greatly beautified and enlarged by him. They who allow 1300 years to the first Assyrian empire, run up nearly to the times of Nimrod, founding their supposition upon the antiquity of the city. But Herodotus, who gives it only 520 years, speaks of its duration from Ninus, under whom the Assyrians extended their conquests over all the Upper Asia.—Under this conqueror we are to place the founding, or rather rebuilding, of the ancient city of Tyre, which afterwards became so famous by its navigation and colonies.—Here too, or very soon after, probably in the time of Abimelech, come in the famous exploits of Hercules, the son of Amphytrion, and of Thesus, king of Athens. This last united the twelve districts of Attica into one large city, and gave a better form to the Athenian government. In the reign of Semiramis, so famous for her conquests and magnificent works, and while Jephthah judged Israel, Troy, which had been already once taken by the Greeks in the time of Laomedan, was a second time taken and reduced to ashes by the same Greeks, in that of Priam, the son of Leomedan, after a siege of ten years.

Fifth epocha.—The taking of Troy.

This epocha of the destruction of Troy, which happened about 308 years after the departure out of Egypt, and in the 3530th year of the Julian period, is considerable, not only on account of the greatness of the event,
2820 celebrated by so many famous poets both Greek and Latin, but also because it furnishes a proper date in taking account of the fabulous and heroic times. These ages of fiction and romance, where the poets place their heroes the offspring of the Gods, are not very remote from the æra we are speaking of. For, in the time of Laomedon, the father of Priam, appeared all the worthies concerned in the expedition of the Golden fleece, Jason, Hercules, Orpheus, Castor, Pollux, &c. and even in the age of Priam himself we see Achilles, Agamemnon, Menelaus, Hector, Ulysses, Diomedes, Sarpedon the son of Jupiter, Æneas the son of Venus, whom the Romans acknowledged for their father and founder, with many others, the boasts of nations, and the pride of the most

renowned families. Round this epocha, therefore, we may gather what is most illustrious and great in the heroic times. But the transactions of holy writ, during this period, are yet more astonishing. The prodigious strength of Samson and his amazing exploits, the administration of Eli, Samuel the chosen prophet of God, Saul, the first king of Israel, his victories, presumption, and unhappy fall, are events that may well raise our wonder and admiration. About this time Codrus, king of Athens, devoted himself to death for the safety of his country. His sons, Medon and Nileus, disputed about the succession; whereupon the Athenians abolished the regal power, and created perpetual governors, or magistrates for life, but answerable for their conduct, who were distinguished by the name of Archons. Medon, the son of Codrus, was the first who exercised that office, and it continued a long time in his family. To this age we must also refer the settlement of several Athenian colonies in that part of Asia Minor, called Ionia. The Æolian colonies settled there much about the same time, and all Asia Minor was covered with Greek cities. In the kingdom of
Israel, Saul was succeeded by David, who at first 2940
was acknowledged as king by the house of Judah
only; but, upon the death of Ishbosheth, all the tribes owned his authority. He proved a valiant and fortunate prince, greatly enlarged his dominions, and advanced the Israelites to a degree of wealth and power far exceeding any thing they had known before. But, what is still more, he was the distinguished favourite of heaven, and is stiled, in scripture, a man according to God's own heart. To this pious warrior succeeded Solomon, famed for his wisdom, justice, and pacific virtues; whose hands, unpolluted with blood, were declared worthy to raise a temple to the Most High.

Sixth epocha.—The Temple.

It was in the 3702d year of the Julian period, and 480th after the departure out of Egypt, and, to connect sacred history with prophane, 72 years after the taking of Troy, and 264 before the building of Rome, that Solomon
laid the foundation of the temple. The other par- 2992
ticulars of his reign are fully record ed in holy writ,

where he appears at once an instance of all that is great and little in human nature. Under his son Reho-
3029 boam Israel was parted into two kingdoms; one called, by way of distinction, the kingdom of Israel, and consisting of the ten tribes who associated under Jeroboam; the other, known by the name of the kingdom of Judah, composed of such as adhered to the house of David. The kings of Egypt seem at this time to be very powerful; and many are of opinion, that the Shisak of scripture, whom God made use of to punish the impieties of Rehoboam, is the same with that famous conqueror so renowned in prophane history under the name of
3033 Sesostris. In the reign of Abiah, the son of Rehoboam, we see the piety of that prince rewarded with a memorable victory over the revolted tribes. In the time of Asa, his son and successor, Omri king of Israel, built Samaria, which thenceforth became
3080 the capital of that kingdom. Next follow the pious reign of Jehosaphat in Judah, and the idolatry and impieties of Ahab and Jezebel in Israel, with the signal vengeance of heaven for the blood of Naboth.—About this time we are to place the foundation of Carthage by Dido, who transported a colony of Tyrians into Africa, chose a place for her new city conveniently situated for traffic. The mixture of Tyrians and Africans contributed to the making it both a warlike and a trading city, as will appear in the sequel. Judah and Israel were in the mean time a scene of amazing revolutions and wonders. Jehoram, by marrying the daughter of Ahab, was seduced into the idolatry of that wicked family, and drew down upon himself the vengeance of heaven. Jehu takes possession of the throne of Israel and de-
3120 stroys the whole posterity of Ahab. Jehoram, king of Judah, and Ahaziah, his son, with the greatest part of the royal family, are all slain about the same time, as allies and friends of the house of Ahab. Athaliah, upon hearing this news, resolves utterly to extinguish the house of David; and, putting to death all that remained of that family, even to her own children, usurps the crown of Judah. But Joash, preserved by the care of Jehoshebah, his aunt, and brought up privately in the temple of Jehoiada the high priest, after six years put an end to the usurpation and life of Athaliah. During all this time, Elijah and Elisha were working those wonders

and miracles in Israel, which have made their names so famous in holy writ. Let us now look abroad a little into prophane history, which begins to furnish more ample materials, and entertain us with the gradual rise of those Grecian commonwealths that made so great a figure in ancient times: for, during the period we are speaking of, according to the most received opinion, flourished Lycurgus, the famous Spartan lawgiver. The bounds we have prescribed ourselves in this discourse, will not allow of our laying before the reader a scheme of those admirable institutions which rendered Lacedæmon the most powerful and illustrious city of Greece. They may be read at large in the histories of those times. We shall only observe, that, as it was the chief aim of this lawgiver to banish luxury and avarice, and introduce a warlike spirit among the people, nothing could be more happily contrived for this purpose, than his equal distribution of the lands of the commonwealth, his prohibition of all gold and silver coin, and that laborious temperate kind of life, habituated to the exercises of war, in which every citizen was trained up from his infancy. In a word, it is commendation enough to say, that while Sparta adhered to the establishments of Lycurgus, she was invincible in herself, and respected by all the world. Some time before Lycurgus, flourished Homer and Hesiod, the two renowned Grecian poets. We see, in their works, the amiable simplicity of those ancient times; and, though history has left us very much in the dark as to the early ages they describe, yet it is abundantly plain from their writings, that the Greeks were by this time a powerful people, and had made considerable advances in all the different branches of human learning. In Judah, Joash, during the life of Jehoiada, ruled the people with wisdom and justice; but, after the death of that great man, he became a very tyrant,
insomuch that he ordered Zechariah the high 3164
priest, the son of his benefactor, to be stoned to
death. But heaven did not long defer vengeance for this act of perfidy and ingratitude. The year following, being beaten by the Syrians, he fell into contempt, and was slain by his own servants. Amaziah, his son, succeeded him in the throne. Meanwhile the kingdom of Israel, which had been greatly weakened under the successors of Jehu, by its almost continual wars with the kings of Damascus, began to recover and flourish by the wise and vigorous ad-

ministration of Jeroboam the Second, who exceed-
3179 ed in piety and valour all that had gone before
him. Nor did Uzziah, or Azariah, the son of Ama-
3194 ziah, acquire less glory in Judah. In the 24th
year of his reign, the famous computation by the
3228 Olympiads, of which we have already spoken in
our chronology. It is celebrated in history, not only as being the great epocha of the Greeks, but also because here, according to Varro, the fabulous times end. They are so named on account of the many fables which the poets have interwoven with the transactions they describe, insomuch that it is almost impossible to distinguish truth from falsehood.

Varro divided the whole series of time into three periods. The first extended from the creation of the world to the deluge, and is by him called the unknown age, there being nothing in prophane historians relating to that time which has any appearance of truth. The second period reached from the deluge to the first olympiad, and this is what he stiled the fabulous, for the reasons mentioned above. The third and last, beginning with the first olympiad, was carried down to the age in which that author wrote, and may by us be extended to the present times He calls it the historical period, because henceforward the transactions of mankind are handed down to us by faithful and authentic relations; so that the Olympiads, while they constitute the great epocha of the Greeks, are at the same time to be considered as the æra of true history.—However, this holds only in respect of the transactions of the heathen world, inasmuch as holy writ furnishes a true and authentic relation of the affairs of the chosen people, from the times of Abraham the father and founder of the Jewish nation; and has even traced things back, in a general summary, to the first formation of the universe.—By this means we have been enabled to give the reader a just account of the progress of human affairs; and, deducing history from its source, have preserved the chain of ages unbroken, and disposed of the scattered fragments of prophane history, according to the true places they ought to possess in the general course of time. Sacred history is very soon going to leave us; but we may esteem it a happiness, that, having conducted us with certainty thus far, we are arrived at a period where the relations of other writers may be depended on. Thus the thread of

history is continued, we see ages succeeding one another in a connected series, we can pursue the affairs of mankind in a just and orderly progression, from their first original to the times in which we live. But to return whence we digressed. Azariah was succeeded in the kingdom of Judah by his son Jotham, who proved a wise and pious prince. Israel, meanwhile, was torn with intestine divisions. Shallum had slain Zachariah, the son of Jeroboam, and usurped the crown; which, inspiring Menahem with hopes of gratifying his ambition by the like means, he conspired against the usurped, and served him as he had done his lawful prince. Pul was at this
time King of Assyria, who, taking advantages of 3233
these disturbances in Israel, advanced against it
with an army. But Menahem found means to satisfy him by a present of a thousand talents. Archbishop Usher conjectures this Pul to have been the father of Sardanapalus, imagining that name to imply as much as Sardan the son of Pul. It was in the reign of this Sardanapulus, that the Athenians, whose disposition was pushing them on insensibly to a popular government, upon the death of Alcmeon, the last of their perpetual archons, retrenched the powers of these magistrates, and limited their administration to ten years. Charops, was the first who held this dignity under these restrictions. But we must now turn our eyes towards Italy, and take a view of the first beginnings of that empire, which is in time to swallow up all the rest, and spread its victories to the remotest regions of the known world. After the destruction of Troy, Æneas, gathering together a few remains of his unhappy countrymen, sailed for Italy; where, marrying the daughter of King Latinus, he succeeded him in the throne, and left it to his posterity. This race of Latin Kings held the sovereignty for upwards of three hundred years; nor do we read of any remarkable revolution till the time of Numitor and Amulius. But then Amulius seizing upon the crown, to the prejudice of his elder brother Numitor, remained possessed of it till Romulus and Remus, the sons of Ilia, Numitor's daughter, arriving at manhood, restored their grandfather to his inheritance, and slew the usurper.

Seventh epocha.—The building of Rome.

The revolution was followed soon after by the building

of Rome, in the reign of Jotham, King of Judah.
3250 The Romans, (according to Plutarch and others) began to build on the 21st of April. The day was then consecrated to Pales, goddess of shepherds; so that the festival of Pales, and that of the foundation of the city, were afterwards jointly celebrated at Rome on the same day. This æra, so remarkable in history, as serving the best of any to direct us in regulating our accounts of the Western and European nations, is removed but a few years from another of no less note in the eastern chronology. For, about six years after the building of Rome, according to the computation of Varro, happened the downfall of the Assyrian monarchy, occasioned chiefly by the effeminacy of Sardanapulus. This prince, neglecting wholly the administration of public affairs, and shutting himself up in his palace amongst his women and eunuchs, fell into contempt with his subjects; whereupon Arbaces, governor of Media, and Belesis, governor of Babylon, conspiring against him, besieged him in his capital, and reduced him at last to the necessity of perishing miserably with his wives and eunuchs in the flames of his own palace. Upon the dissolution of this mighty empire, there arose two others in its stead, founded by the two leaders of the conspiracy. Belesis had Babylon, Chaldea, and Arabia; and Arbaces all the rest. Belesis is the same with Nabonassar, from the beginning of whose reign at Babylon commences the famous astronomical æra we are speaking of, from him called the æra of Nabonassar. For this æra we are beholden to Ptolemy's canon, which, beginning with Nabonassar, carries down the succession of the Babylonian Kings, and afterwards of the Persian and Macedonian, quite beyond the birth of Christ. This canon is a sure guide in regard to the eastern chronology, and comes in the most opportunely that can be imagined for the connecting of sacred and profane history. For, as it commenceth several years before the Babylonish captivity, by which the course of the Jewish history is interrupted, we can here take up the series, and continue down the account of time with certainty to the beginning of the Christian æra. The first year of Nabonas-
3257 sar coincides with the seventh year of Rome, the second of the 8th Olympiad, the 747th before Christ, and the 3967th of the Julian period. In the mean time Ahaz, having succeeded his father Jotham in the king-

dom of Judah, was attacked by Rezin, king of Syria, and Pekah, king of Israel; whereupon, applying to the king of Assyria, who is in scripture called Tiglath-Pileser, he readily obtained his assistance. This Tiglath-Pileser is by some conjectured to be the same with Arbaces the Mede; but the more probable opinion is, that he was of the royal family of Assyria, his name Tiglath-Pul-Assar having a plain resemblance of Pul and Sardan-Pul, the names of the two former kings. It is likely, therefore, that taking advantage of the confusion that followed upon the dissolution of the Assyrian monarchy, and the division of it between Arbaces and Belesis, he put himself at the head of those who still adhered to the house of Pul, and getting possession of Ninevah, there established a third empire for himself, while Arbaces and Belesis were employed in settling themselves in the provinces they had respectively governed under the former monarch. Thus we see a second Assyrian empire rising out of the ruins of the former, of which Nineveh, as before, remained the capital. Tiglath-Pileser coming with a great army to the assistance of Ahaz, took Damascus, and entirely destroyed the kingdom of Syria, uniting it to his own. He likewise greatly distressed that of Israel, and even ravaged the territories of his friend and ally, king Ahaz. By this means were the kings of Assyria first introduced into Palestine, which, finding to lie convenient for them, they resolved to make a part of their empire. They began with the kingdom of Israel, which Salmaneser, the son and suc-
cessor of Tiglath-Pileser, entirely subdued, throw- 3283
ing Hosea, the king thereof, into prison, and car-
rying the people into captivity. About this time died Romulus, the first king of Rome, after a reign of 37 years. He was all his life engaged in wars, and always returned from them victorious. But this hindered him not from attending both to the civil and religious establishment of his new colony, where he laid the first foundation of those laws and institutions that contributed so much to
the advancement of the Roman empire. A long 3290
and uninterrupted peace gave Numa his successor
an opportunity of finishing his work, by softening the manners of the people, and bringing their religion into a more exact form. In this time several colonies from Corinth and other parts of Greece, built Syracuse in Sicily; and likewise Crotona and Tarentum, in that part of Italy cal-

led Magna Græcia by reason of the many Greek colonies already settled there. Meanwhile Hezekiah had succeeded Ahaz in the throne of Judah. He was a prince renowned for piety and justice! and so much the favourite of heaven, that it interposed in a miraculous manner both in recovering him from a remarkable sickness, and delivering him from the menaces of Sennacherib, king of Assyria. But Manasseh, his son, not treading in his steps, was sold into the hands of Esarhaddon, the successor of Sennacherib. This prince was wise and politic; he re-united the kingdom of Babylon to that of Nineveh, and by his many conquests, equalled, if not exceeded, in extent of dominion, the ancient Assyrian monarchs. While Esarhaddon was thus enlarging his empire, the Medes were beginning to render themselves considerable by the wise administration of Deioces, their first king. He had been raised to the throne on account of his virtue, and to put an end to the disorders occasioned by the anarchy

3290 under which his countrymen then lived. He built the city of Ecbatana, and laid the foundations of a mighty empire. Rome begins now to increase in power and territory, though by slow advances at first. Under Tullus Hostilius, her third king, and in the 83d

3332 year of the city, happened the famous combat of the Horatii and Curiatii, by which Alba was subjected, and its citizens incorporated with the victorious Romans. At this period begins the reign of Psam-

3334 mitichus, in Egypt. It had some time before been divided into twelve parts, over which reigned twelve princes, who as a monument of their union, built the famous labyrinth. But Psammitichus, who was one of them, incurring the jealousy of the rest, they expelled him; whereupon he drew an army together, subdued and dethroned the eleven confederate princes, and seized on the whole kingdom for himself. As the Ionians and Carians had been very serviceable to him in this revolution, he granted them an establishment in Egypt, hitherto inaccessible to strangers. On this occasion began the first commerce between the Egyptians and Greeks, which as it was ever after constantly kept up, we are to account this, according to Herodotus, the æra of true Egyptian history, all that goes before being so darkened by the fables and inventions of the priests, that it seems

3348 very little worthy of credit. In Media, Phraortes succeeded his father Deioces, and after a reign of

32 years left the kingdom to his son Cyaxeres, in whose
time happened the irruption of the Scythians, who, van-
quishing Cyaxares in battle, dispossessed him of all the
Upper Asia, and reigned there twenty-eight years. In Ju-
dah, Ammon succeeding Manasseh, after a short reign, left
the kingdom to his son Josiah, who proved a pious prince,
and thoroughly reformed the Jewish state. Rome, in the
mean time, was enlarging her territories under her fourth
king, Ancus Marcuis, and by the wise establishment of
incorporating the conquered nations, increased in power
and the number of her citizens. Babylon, we have seen,
had been re-united to Nineveh, and so continued till the
reign of Chiniladan; but he proving an effeminate prince,
Nabopollasar, whom he had made general of his armies
against Cyaxares the Mede, rebelled against him, and join-
ing with Astyages, the son of Cyaxares, invested
Nineveh, took the place, and slew his master Chi- 3378
niladan, called otherwise Saracus. After which,
to gratify the Medes, he utterly destroyed that great and
ancient city; and from that time Babylon became the sole
metropolis of the Assyrian empire. Nabopollasar was
succeeded by his son Nebuchadnezzar, a prince
renowned in history, and who, by his mighty con- 3397
quests, both in the east and west, raised Babylon
to be the metropolis of the world. By him was Jerusalem
taken three several times, and at last totally destroyed;
the whole people of Judah being led into bondage by the
conqueror. This is the famous Babylonish captivity of
seventy years, so often mentioned in the writings of the
prophets. Greece was at this time in a very flourishing
way, and began to discover her acquirements in learning
and the polite arts. Her seven sages rendered her
famous; and Solon, by the wise laws which he 3410
established at Athens, reconciling liberty and jus-
tice, introduced such regulations among the citizens as
naturally conduced to the forming them a brave and know-
ing people. Tarquinius Priscua now reigned at Rome.—
He subdued part of Tuscany; and having adorned the
city with many magnificent works, left the
throne to Servius Tullius. This prince is famous 3425
for the institution of the *census*, and the many laws
he made in favour of the people. In Egypt, Psamittichus,
after a reign of 54 years, was succeeded by his son
Nechus, the same who in scripture is called Pha- 3394
raoh Necho. It was against him that Josiah, king

of Judah fought that unhappy battle in the valley of Megiddo, where he received the fatal wound of which he died. Nechus was succeeded by Psammis, who left the kingdom to his son Apries, the Pharaoh Hophra of the scripture, against whom so many prophecies are levelled. The first year of Apries was the last of Cyaxares King of the Medes, who, after a reign of 40
3410 years, was succeeded by his son Astyages. Nebuchadnezzar in Babylon, having finished all his expe-
3434 ditions, and greatly enriched himself with the spoils of the conquered nations, set himself to adorn that city, and raised all those stupendous works, about it of which we read with so much wonder in ancient history. Evilmerodach his son, after a short reign of two years,
3444 becoming intolerable even to his own relations, they conspired against him, and slew him. Neriglissar, his sister's husband, who headed the conspiracy, succeeded him. About this time Pisistratus usurped the sovereign authority at Athens, which he held with various changes of fortune thirty years, and even left it to his children. The Medes meanwhile were increasing in power under Astyages, which rousing the jealousy of Neriglissar, King of Babylon, he declared war against them. Astyages dying, leaves both the kingdom and the care of the war to Cyaxares his son, called by Daniel, Darius the Mede. As the war wherewith he was threatened was very formidable, he applied to the King of Persia, who had married his sister Mandana, for assistance. Cambyses sent a good body of troops, and with them
3445 Cyrus his son, nephew to Cyaxares, whom that prince appointed general of his armies against the King of Babylon. Cyrus was a young prince of great hopes and had already given signal proofs of courage and conduct in several former wars under Astyages his grandfather. But his virtues now going to display themselves in all their lustre, and present us with the picture of a hero, who, by a train of the most glorious actions, has justly merited to be handed down to posterity as a pattern of all that is truly great and praiseworthy in the character of a prince and a ruler. The very name of Cyrus carried such a weight and authority with it as to draw into the alliance of Cyaxares almost all the Kings of the east, nor was it long before he gave proofs of that merit which was already so universally ascribed to him. For having by his superior abilities in the art of war, vanquished the

king of Babylon, and Crœsus, his ally in battle, he pursued his advantage over the latter, surrounded him in his capital, and got possession both of his kingdom and
immense riches. With the same expedition he 3456
subdued the other allies of the king of Babylon,
made himself master of all Asia Minor, and extended his conquests even into Syria. In fine, he marched against Babylon itself, took that mighty city, and thereby became master of the whole Assyrian empire, which he put under the dominion and authority of his uncle Cyaxares; who now, equally touched with this signal proof of his fidelity, as before with his glorious exploits, gave him his only daughter in marriage. Cyaxares dying within two years, as likewise Cambyses, king of Persia, Cyrus succeeded to the whole monarchy. In this manner was the empire of the East transferred from the Assyrians to the Medes and Persians. But as Cyrus was himself a Persian, and all his successors after him of the same nation, hence it has happened, that this second great empire, as it ought to be accounted, obtains in ancient history the name of the Persian monarchy; Cyrus, and not Cyaxares being reputed the founder thereof. And, indeed, when we consider that Cyrus alone headed the Medes during this long war, that it was to his valour and wisdom they were indebted for all their conquests, and that he in person took the great city of Babylon, it seems but just to ascribe to him the honour of this whole revolution. For these reasons we have chosen to date the beginning of this second great empire, not from the taking of Babylon, but from the succession of Cyrus, who alone can with justice be accounted the founder thereof.

Eighth epocha.—The reign of Cyrus.

In the 4178th year of the Julian period, 218 years after the building of Rome, and 536 before the birth of Christ, Cyrus succeeding to the throne of Cyaxares, and becoming sole monarch of all the east, here we are to fix the beginning of the Persian empire. In the first year of his reign he published the famous decree for re-build-
ing the temple of Jerusalem; the seventy years 3468
captivity being now completed, according as had
been foretold by the prophets. Servius Tullius still reigned at Rome. He had greatly enlarged the city, and by

his mild and popular administration was become the darling of his subjects. This excellent prince fell a sacrifice at last to the perfidy of his own daughter, and the
3470 ambitious designs of his son in law, Tarquin, the Proud, who succeeded him in the throne. Cyrus,
3475 after a reign of seven years, left his kingdom to his son Cambyses. Under him the Persians enlarged their empire by the conquest of Egypt. He proved, however, a very brutal prince, unworthy to fill the throne of Cyrus. His brother, Smerdis, he ordered to be killed privately, on account of a suspicious dream that had disturbed his fancy. He did not long survive him, and upon his death Smerdis, the Magian, usurped the throne, under pretence of being the true Smerdis, the son of Cyrus. However, the cheat was soon discovered, which gave occasion to the famous confederacy of the
3483 seven noblemen, the result of which was, that Darius, the son of Hystaspes, was raised to the Persian throne. During the reign of this prince, Athens recovered its liberty. Harmodius and Aristogiton delivered their country from the tyranny of Hipparchus, the son of Pisistratus, by slaying the tyrant; and Hippias,
3494 his brother, was obliged to throw himself into the arms of Darius. This was what gave rise to the wars between the Persians and the Greeks. From hence are we to date the mighty glory of Athens. We shall soon see this small commonwealth an over match for all the power of the east; so true it is, that liberty ennobles the mind, and affords the truest foundation whereon to build the grandeur of a state. About the time of this revolution at Athens, happened another of the like nature at Rome. Tarquin, by his violence and arbitrary measures, had rendered the royal power odious, and the attempt of his son Sextus upon Lucretia, completed the public indignation. The people, animated by the speeches and heroic behaviour of Brutus, shake off the regal tyranny, and declare themselves a free state. This æra of the Roman liberty commenceth from the 244th year
3496 after the building of the city. Tarquin, however, found means to draw in several neighbouring princes to espouse his quarrel, among whom Porsenna, king of the Clusians, bears the most distinguished name in history. It is upon this occasion that the Romans first began to discover that noble ardour for liberty, that in-

violable love of their country, which makes a bright part of the character of that renowned people. Here we may read of the astonishing valour of Horatius Cocles, the intrepid spirit of Scævola, and the masculine boldness of Clelia. Porsenna, admiring the bravery of the Romans, would not any longer disturb them in the enjoyment of a liberty to which their merit gave them so just a title.—But they who could not be overcome by any foreign force, had well nigh ruined themselves by their intestine divisions. The jealousy between the patricians and plebeians rose to that height, that the latter retired from the city, and intrenched themselves upon a hill, called afterwards *Mons Sacer*. However, the mild persuasions of Menenius Agrippa, and the concession made by the senate of new plebeian magistrates, whose office it was to protect the people against the consuls, appeased their discontents, and restored tranquillity to the state. The law appointing the institution of these magistrates was called the sacred law, and the magistrates themselves had the title of tribunes of the people. This remarkable revolution happened in the 260th year of the city. Hippias, we
have seen, had retired into Persia, and was soli- 3510
citing Darius to make war upon the Athenians.
He at length prevailed, and Mardonius was sent 3514
with a numerous army against them. But Miltiades, with a handful of men, gave the Persians battle on the plains of Marathon, and entirely routed them. This victory is the most renowned in ancient history, for the Athenians did not exceed ten thousand, and the Persians have been computed at twenty times their number. At Rome the feuds between the nobility and the people still subsisted. The banishment of Coriolanus had well nigh proved fatal to the commonwealth, which owed its
deliverance from the imminent danger that threaten- 3516
ed it to the tears of the incensed hero's mother.
In the mean time, Xerxes succeeding Darius in the 3519
throne of Persia, prepared to revenge the defeat at Marathon, by a new expedition against Greece. He is said to have been followed in this attempt by an army of seventeen hundred thousand men. Leonidas,
king of Sparta, with only three hundred Lacede- 3524
monians, encountered his whole force in the streights of Thermopylæ. For three days he made good the passes against the numerous army of the Persians; but being at length surrounded, he and his followers were all

slain upon the spot. By the wise counsels of Themistocles, the Athenian admiral, the naval army of the Persians was this same year vanquished near Salamis; and Xerxes, in great fear, repassed the Hellespont, leaving the command of his land forces to Mardonius. But he,
3525 too, the year after, was cut in pieces with his whole army near Platæa, by Pausanias, king of the Lacedemonians, and Aristides, surnamed the Just, general of the Athenians. The battle was fought in the morning, and the evening of the same day their naval forces obtained a memorable victory over the remainder of the Persian fleet at Mycle, a promontory on the continent of Asia.—Thus ended all the great designs of Xerxes in a miserable disappointment, and the utter destruction of that prodigious army with which the year before he had marched so proudly over the Hellespont. The Carthaginians, by this time a powerful people, had been engaged by Xerxes to fall upon the Greek colonies in Sicily, while he was employed against them in their own country; but they had no better success than the Persian monarch, and being shamefully beaten, were obliged to abandon the island.

Xerxes, dying after a reign of 21 years, was suc-
3540 ceeded in his kingdom by Artaxerxes Longimanus. He is generally supposed to be the king from whom Nehemiah received the commission to restore and rebuild Jerusalem. But it is now time to turn our thoughts a little towards the Romans, who, having been formed under kings, were but ill provided with laws suited to the constitution of a republic. The reputation of Greece, yet more renowned for the wisdom of its government than the fame of its victories, determined the Romans to draw up a scheme of laws upon their model. Deputies were therefore sent to examine into the constitution of the several Greek cities, particularly those of Athens, whose
3554 plan of government seemed to have a greater resemblance with that of Rome. Ten magistrates were elected, with absolute authority, to carry this design into execution. The decemvirs accordingly composed a body of laws, which having digested into twelve tables, they were proposed to the people, and received their approbation. It was natural to think, that these magistrates, having finished the business for which they were chosen, would, upon the expiration of their term of power, have resigned their offices, and suffered the government to return to its former course. But it seems they found too

many charms in authority to quit it so readily; they aimed at no less than perpetuating their command, and vainly thought to entail slavery upon a state whose prevailing passion was the love of liberty. Power usurped by unlawful means seldom abstains from violence and excesses; and the very methods taken to establish it, prove often in the end the cause of its destruction. And so it happened here; for, the Decemvirs declining from that moderation by which they had, in the beginning of their authority, recommended themselves to the favour of the people, a general discontent arose; and the iniquitous decree of Appius, whereby he reduced a father to the cruel necessity of murdering his own daughter, so effectually roused the ancient Roman spirit, that disdaining to submit any longer to these oppressors, they abolished the Decemvirate, and restored the authority of the consuls. Thus did the blood of Virginia produce a revolution in the Roman state, not unlike what had before happened in the case of Lucretia. About this time Cimon, the Athenian general, rendered himself famous by his many victories over the Persians, insomuch that Artaxerxes, weary of so destructive a war, signed a treaty of peace highly to the honour and advantage of Greece. He had resolved to pursue a different scheme of politics; and, instead of drawing their whole forces upon himself, endeavoured to weaken them by fomenting their intestine divisions. The war that
soon after broke out between the Athenians and 3573
Lacedemonians, made him sensible of the advantages that might accrue from such a conduct. It was during this war, described at large by Thucydides and Xenophon, and known in history under the name of the Peloponnesian war, that we read of Pericles, Alcibiades, Thrasybulus, Conon, Brasidas, and Lysander. So many illustrious men, all flourishing in the same age, contributed to raise Greece to the highest pitch of glory, and spread her fame to the most distant nations. This fatal
war, after it had lasted 27 years, ended at length 3600
in the taking of Athens by Lysander, who had found means to draw into the party of Lacedemonians, Darius Nothus, the son and successor of Artaxerxes. But the Persians soon became sensible of the error they had committed in making the Lacedemonians too pow-
erful; for that ambitious republic, having now no 3603
rival to fear, began to extend its view to Asia, and even promoted the expedition of young Cyrus against his

brother Artaxerxes Memnon, who had succeeded Darius Nothus. This ambitious prince fell in battle by his own rashness, and left the ten thousand Greeks who served under him exposed to all the dangers of war in an unknown country, several hundreds of miles distant from their own homes, and surrounded on every side with numerous armies. There is not any thing in history more celebrated than this retreat, which has been handed down to us by Xenophon, who himself conducted it, and was one of the ablest commanders, and greatest philosophers, of his time. Thus were the Greeks first made
3600 sensible of the real weakness of the Persian em-
pire, hitherto deemed so formidable; and the exploits of Agesilaus, in Asia, soon after, where he bade fair for overturning that mighty monarchy, had he not been recalled by the unhappy divisions of his country, were a plain proof that nothing was wanting but a good general and union among themselves to complete the conquest of the east. Rome was rendering herself formidable
3610 to all the nations around her; and Vei, one of the
strongest and most opulent cities in Italy, was taken by Camillus after a siege of ten years. But this great increase of territory was soon followed by a fatal calamity that brought the republic to the brink of ruin; we mean the irruption of the Gauls, who defeated the Ro-
3615 man army; and advancing against the city itself,
laid it in ashes in the 363d year after it had been founded by Romulus. Such of the senators and nobles as chose to survive the ruin of their country, retired into the capital with Manlius, where they resolutely defended themselves till they were relieved by Camillus, whose ill usage and banishment had not diminished his regard to his country. Thus was Rome again restored to her former splendour by the conduct and bravery of that great man. In Greece the Lacedemonian power began to decline; and Thebes, which hitherto made no figure in the history of that nation, raised herself to the highest pitch of glory by the wisdom and valour of Epaminondas. This general is one of the most illustrious characters of antiquity. He was possessed in an eminent degree of all the virtues requisite in a warrior and a statesman. Nor was he less distinguished by his abilities as a philosopher, and his amiable qualities in private life; insomuch that historians unanimously represent him as a pattern of all that is great and excellent in human nature.

Thebes, after his death, lost that conspicuous figure he had given her, and was no longer able to maintain her reputation. Indeed all Greece is going to submit to a new power, which, beginning in Philip, rose at last to the dominion of all Asia under his son and successor Alexander. This Philip was King of Macedon, and had been bred up under Epaminondas. As he was of an enterprising genius, and gave early proofs of his unbounded ambition, all the neighbouring powers set themselves to oppose his growing greatness. But though Ochus and his son Arses, Kings of Persia, did their utmost to thwart his designs; though the Athenians, roused by the eloquence of Demosthenes, that intrepid defender of his country's liberties, drew almost all Greece into a confederacy against him; he, notwithstanding, triumphed over every difficulty, and the victory of Choronea rendered him absolute in all the Gre-
cian states. He was now forming the plan of an 3665
expedition into the east; and had projected nothing less than the total overthrow of the Persian empire, when an untimely death hurried him out of the
world. Alexander, surnamed the Great, his son, 3668
succeeded him; a prince who from his earliest years had given proofs of an heroic soul, that seemed destined for the conquest of the universe. Much about the same time Darius Codomannus ascended the throne of Persia. He had in a private station distinguished himself by his valour and prudence; but it being his fate to encounter the prevailing fortune of Alexander, all his efforts proved insufficient to support him against that formidable rival. For Alexander, having first settled the affairs of Greece, over-ran Asia Minor with amazing rapidity, defeated Darius in three pitched battles; and, upon the death of that prince, who was treacherously slain by Bessus, became sole monarch of all the east.

Ninth epocha—Alexander the Great.

Here then begins our 9th epocha, not from Alexander's succession to the throne of Macedonia, but from the death of Darius, in whom the Persian empire ended. For Alexander pursuing his victories with the utmost expe-
dition, and having made himself master of almost 3674
all the provinces of the east, became thereby the

founder of the third, or Macedonian empire. This happened in the 4384th year of the Julian period, 424 years after the building of Rome, and 330 before the birth of Christ. During this victorious progress of Alexander, Rome was engaged in a long war with the Samnites, whom after many battles she at length subdued, chiefly by the valour and conduct of Papirius Cursor, one of the
3681 greatest generals of his time. Alexander still continuing his conquests, penetrated as far as India, and returning to Babylon, there died in the 33d year of his age. After his death, his empire was variously divided among his followers. Perdiccas, Ptolemy, the son of Lagus, Antigonus, Seleucus, Lysimachus, Antipater, and his son Cassander, who had been all commanders under this great conqueror, and learned from him the art of war, formed a design of rendering themselves masters of the several provinces over which they were constituted governors. They sacrificed to their ambition the whole family of Alexander; his brother, his mother, his wives, his children, and even his sisters. Nothing was to be seen but wars, bloodshed, and ceaseless revolutions. During these disorders several places of Asia Minor shook off the Macedonian yoke, and established themselves into independent kingdoms. In this manner were the realms of Pontus, Bithynia and Pergamus formed, which, by their advantageous situation, and a steady application to traffic, rose afterwards to great wealth and power. Armenia too about the same time became a distinct kingdom; and Mithridates, with his son of the same name, founded that of Cappadocia. But the two most considerable monarchies that arose upon this occasion were that of Egypt, founded by Ptolemy the son of Lagus, and that of Asia, or Syria, founded by Seleucus; for these continued steady and permanent, and were inherited by their posterity, the Ptolemies and Seleucidæ, for many years. Thus was all the east subject to Greece, and received its language and customs, insomuch that, though it was not under the dominion of one prince as formerly, yet the Greeks universally bearing away in those several principalities into which it was divided, this hath seemed a sufficient reason to historians for styling the times we are spreaking of the period of the Grecian or Macedonian empire. In Greece we meet with nothing but a continued train of revolutions. Cassander, Pyrrhus, King of Epirus, Demetrius Poliocerter,

Lysimachus, and Seleucus, reigned successively in Macedonia; each establishing himself by the expulsion of his predecessor. The Romans were all this while extending their conquests in Italy; and having subdued the Samnites, Brutians, and Hetrurians, threatened Tarentum with the same yoke. The Tarentines, finding themselves too weak to resist that powerful republic, cast their eyes upon Pyrrhus, King of Epirus, whose great military fame made them believe they should be invincible under so renowned a commander. Pyrrhus obtained two successive victories over the Romans, but in the end was beaten by the consul Curius, and forced to abandon 3725
Italy. Antigonus Gonatus got possession of the 3732
throne of Macedonia, and left it to his posterity, though not without great opposition from Pyrrhus, who was killed at length at Argos, by a tile thrown from a housetop. The Achean league, projected and set on foot by Aratas, began about this time to make a figure in Greece. It was a confederacy of several powerful cities of Peloponnesus and the adjoining regions, in defence of liberty, and indeed the last effort made by the Greeks to maintain their independency and freedom. In Italy, the Romans, after the departure of Pyrrhus, found nothing able to oppose their power. They had been enlarging their territories by an almost continual series of wars for upwards of 480 years, and now found themselves masters of the whole country from the farthest part of Hetruria to the Ionian Sea, and from the Tuscan Sea across the Apenines to the Adriatic. Thus their ambition, crowned with success, inspired them with still greater views. The adjoining island of Sicily, as it lay convenient for them, so was it possessed in part by the Carthaginians, a powerful people, whose neighbourhood they began to look upon with an eye of jealousy. We have seen the foundations of this republic by Dido, and that it was considerable for wealth and extent of territory as far back as the reign of Xerxes. At the time we are speaking of, their dominions reached a great way on both sides of the Mediterranean Sea. For, besides the African coast, of which they were entirely masters, they had also many conquests in Spain, settled themselves in Corsica and Sardinia, and possessed several towns in Sicily. This, added to their immense wealth acquired by commerce, and the sovereignty of the sea, which no nation could then dispute with them, made the Romans con-

consider them as formidable rivals, who, if not speedily check-ed, might grow to a power too mighty even for Italy itself.

Hence the rise of the several Punic wars, which in
3740 the end proved so fatal to the Carthaginians. That
we are now to speak of, began in the 490th year of the city; and is remarkable, not only as being the first foreign war in which the Romans were engaged, but also because herein they formed the design of making themselves masters at sea, and, which is almost beyond belief, accomplished it. The consul Duillius ventured to fight the Carthaginian fleet, and obtained a complete victory. Regulus, his successor, no less distinguished himself, and, landing in Africa, reduced Carthage to the greatest extremity; insomuch that, but for the arrival of Xantippus, the Lacedemonian, it must have been taken. That experienced general, by his wise conduct, gave a great turn to the affairs of Africa. Regulus was vanquished and made prisoner; but this reverse of fortune served only to add more lustre to his fame. Being sent into Italy to negotiate a peace, and treat of an exchange of prisoners, he strenuously defended in the senate that law by which it was declared inconsistent with the glory of the Roman name to redeem prisoners taken captive in a day of battle. Upon his return to Africa, we are told, he suffered a cruel death from the resentment of the Carthaginians, who were incapable of admiring that nobleness of soul which made him prefer the interest of his country to all private considerations. The war was maintained for a long time with various success; Hamilcar, the Carthaginian general, distinguishing himself eminently in Sicily by his great military skill. But at last, the consul, Lutatius, obtaining a com-
plete victory over the enemy's fleet, near the Æga-
3764 tian isles, Carthage was obliged to submit, and ac-
cept of such terms as the Romans were pleased to grant. Immediately after the conclusion of this war, which had lasted four and twenty years, the Carthaginians found themselves involved in another, which brought them to the very brink of destruction. The mercenary troops, of which their armies were composed, revolting, for want of their pay, were joined by almost all the cities of Africa, who hated the Carthaginian government. All endeavours to appease them proved ineffectual; they invested Carthage itself; and that great city had been inevitably lost, but for the valour and conduct of Hamilcar, surnamed

Barchas. He found means to vanquish the rebels, and recover all the revolted cities. The Carthaginians, however, upon this occasion, lost Sardinia, by the treachery of the Romans, who, taking advantage of their domestic troubles, seized that important island, and even augmented the tribute they had at the end of the war imposed upon that unhappy state. Carthage was obliged to take all in good part, as not being in a condition to oppose these encroachments. They now began to think of re establishing their dominion in Spain, which had been greatly shaken by the late revolt. Hamilcar was sent to command in that province, where he carried on the war for nine years with great success. His son, the famous Hannibal, was in the camp with him, and not only learned under that renowned commander, the whole art of war, but also at this time contracted that implacable hatred against the Romans, which afterwards gave rise to so many wars. Asdrubal succeeded Hamilcar in the command of the army. He governed with great prudence; and, by his mild and peaceable administration, thoroughly established the Carthaginian power in those parts. Meanwhile, the Romans were engaged in a war with Teuta, Queen of the Illyrians, who suffered her subjects to practise piracy on the sea coast; but she was soon forced to submit, and resign part of her dominions to the conquerors. Their next war was with the Gauls, whom they accounted their most formidable enemies; and therefore, though they began to entertain a jealousy of the increase of the Carthaginian power in Spain, yet not daring to break with that republic in the present critical conjuncture, they sent ambassadors to Asdrubal to draw him by fair words into a treaty, wherein he should covenant not to pass the Iberus, which was accordingly agreed to. Hereupon the Romans applied themselves seriously to the war against the Gauls; and having vanquished them in several battles, passed the Po, pushed on their conquests on the other side of that river, and thereby became masters of all Italy, from the Alps to the Ionian Sea. About this time died Asdrubal in Spain; and Hannibal, at the age of 25, succeeded him in the command of the army. He was the darling of the soldiers, who fancied they saw in him all the virtues they had so often admired in his father Hamilcar. Nor did his behaviour disappoint their expectations; for he completed the conquest of Spain with amazing rapidity; and, thinking himself strong

enough now to enter upon the long-projected war with the Romans, advanced with his army, and invested Saguntum. The complaints of the Roman ambassadors were very little regarded at Carthage. The loss of Sicily, the treacherous behaviour of the Romans in seizing Sardinia, and augmenting the tribute exacted at the end of the war, and their unjust attempts to abridge their power and bound their conquests in Spain, had so irritated the minds of the Carthaginians, that all the endeavours of the faction which opposed Hannibal were fruitless. Hereupon war
3785 was proclaimed against Carthage by order of the Roman Senate, in the 335th year of the city. Meantime Hannibal was taking all the measures necessary to secure the success of his designs. The Italic Gauls were gained over by ambassadors secretly dispatched for that purpose; the nations through which he was to pass were for the most part prevailed on by presents not to oppose his march; and the peace of Africa and Spain were secured by strong detachments of troops, left in those parts, under the command of proper governors. When all things were now ready for the expedition, he crossed the Iberus, traversed the Pyrenees, Transalpine Gaul, and the Alps, and came pouring down with all his forces upon Italy, while the Romans hardly yet imagined him set out from Spain. The Italic Gauls readily joined him, and thereby very seasonably reinforced his army, which had suffered extremely in its passage over the Alps. Four battles, successively lost, made it probable that Rome must soon fall into the hands of this irresistible conqueror. Sicily too followed the fortune of the Carthaginians. Hieronymus, King of Syracuse, declared against the Romans; almost all Italy abandoned them; and the republic seemed deprived of its last resource by the death of the two Scipios in Spain. In this extremity, Rome owed her safety to the valour and conduct of three great men. The firmness of Fabius, who, despising popular rumours, pursued steadily those slow measures by which alone he found Hannibal could be vanquished, served as a rampart to his country. Marcellus, who raised the siege of Nola, and took Syracuse, revived by degrees the courage of the Roman troops. But the glory of conquerining Hannibal, and putting a final end to this dangerous war, was reserved for young Scipio. At the age of twenty-four, he undertook to command in Spain, where his father and uncle

had both lost their lives. Immediately upon his arrival, he invested New Carthage, and took it. His affability and humanity drew almost all the nations of Spain into the alliance of the Romans. The Carthaginians were obliged to abandon that rich and fruitful country; and Scipio, not yet satisfied with so glorious a triumph, pursued them even into Africa. Every thing gave way to his superior valour and abilities. The allies of the Carthaginians forsook them, their armies were defeated, and that haughty republic was now made to tremble in its turn. Even the victorious Hannibal, who had maintained his ground in Italy for sixteen years, in spite of all the efforts of the Romans, was found unable to stop the progress of this young conqueror. Scipio defeated him in a pitched battle, and forced the Carthaginians to submit to the terms of peace he had prescribed to them. In this manner ended the second Punic war, in the 552d year of the city, 3802 just 17 years after its commencement. Scipio was honoured with the surname of Africanus; and Rome, having thus subjected the Gauls and Africans, saw no rival from whose power she had reason to apprehend any danger.

If we now look back a little into the affairs of Asia, which during the times we have been speaking of, were entirely disjointed from those of Europe, we find, that about the middle of the first Punic war, while Antiochus Theos, King of Syria, the son of Antiochus Soter, was engaged in a war with Ptolemy, King of Egypt, Theodotus, governor of Bactria, revolted, and declared himself King of that province. It was now a rich and populous country, and had in it no less than a thousand cities, all which he got under his obedience; and while Antiochus delayed to look that way, by reason of his wars with Egypt, made himself too strong in them to be afterwards reduced. This example was followed by almost all the other nations of the east, particularly the Parthians, who, headed by Arsaces, expelled the Macedonians, and laid the 3754 foundations of an empire, which, in time extended itself over all the Higher Asia, and grew to that strength and power, that not even the Romans themselves, when arrived to their highest pitch of grandeur, were able to shake the throne of the Arsacidæ, for so the Parthian Kings were called, from Arsaces, the founder of their race and empire. These revolts greatly weakened the empire

of the Syrian Kings, for henceforth they were almost entirely excluded from all the provinces that lay beyond the Tigris. Several attempts were indeed made to recover them, but in vain, which obliged them to turn their thoughts towards those parts of their dominions that bordered upon Egypt; insomuch that Judea, which lay between the two kingdoms, became a ground of endless wars and contentions, and occasioned the shedding of torrents of blood. The Romans, after the peace with Carthage, began to turn their thoughts towards Greece. Philip, King of Macedon, had entered into an alliance with Hannibal, when in Italy, and this was looked upon as a sufficient ground for a war. The consul Flaminius was sent against him, who, by his victories
[illegible] reduced the power of that prince, and restored the several cities of Greece to their liberty. Though every thing thus gave way to the Roman power, they could not yet be easy while Hannibal, whom they still looked upon as their most formidable enemy, was alive. They dreaded the bravery and enterprising genius of that great man. Their endeavours to destroy him brought upon them a new war; for, being reduced to fly his country, he took refuge with Antiochus, surnamed the Great, King of Syria; and, inspiring him with a jealousy of the Roman power, persuaded him to oppose their growing greatness. In the management of the war, however, he rejected the wise counsels of this experienced general; and was, therefore, disappointed in all his designs. Beaten by land and sea, he was compelled to submit to the terms of
[illegible] peace imposed by Lucius Scipio, the brother of Scipio Africanus. Hannibal now sought protection from Prusias, King of Bithynia, where finding himself still persecuted by embassies from the Romans, to avoid falling into their hands, he ended his days by a dose of poison. Upon the death of Seleucus, the son of Antiochus the Great, Antiochus Epiphanes, who had been some time a hostage at Rome, got possession of the throne of Syria. He is remarkable for setting on foot a cruel persecution against the Jews, which driving them to extremities, many of them united in their own defence, under Matthias, the father of Judas Maccabeus, so renowned for the many victories he obtained over the numerous armies of the King of Syria. In the mean time, Perseus had succeeded Philip in the kingdom of Macedonia; and, presuming too

much on his wealth and numerous armies, ventured to engage in a war with the Romans. But he was soon made sensible of his unequal strength; and, being 3836
vanquished in battle by Paulus Æmilius, was constrained to surrender himself into his hands. Thus the kingdom of Macedon, which had for near two hundred years given masters not only to Greece, but to all the kingdoms of the east, was now reduced to the form of a Roman province, which leads us to the tenth and last period of our history.

The Roman greatness, indeed, commenceth properly from the total reduction of Italy, and the superiority they gained over the Carthaginians, in the first Punic war. Nevertheless, in regulating the succession of the great empires, the most natural order seems to be that which represents them rising one after another, and establishing each its power and greatness, upon the ruin of that which went before. This is the method we have hitherto followed, and indeed the only one that, according to our apprehension, preserves a due order and distinctness in ancient history. Thus, though upon the death of Sardanapalus, the Assyrian monarchy was dissolved, yet reviving again in the Kings of Nineveh and Babylon, that revolution was not considered as the æra of a new empire; but when the power of the Assyrians was utterly broken, and the dominion of Asia wholly transferred to another people, by Cyrus, where we fixed the beginning of the Persian empire. In like manner, though the Persians were greatly weakened under Xerxes, and his son, Artaxerxes Longimanus, and forced to accept of such terms of peace as Greece was willing to grant them; insomuch, that the Greeks, under Cimon, may be justly said to have given law to the Persian empire; yet, as that monarchy still subsisted under Kings of its own, and was not finally subdued till Alexander passed with an army into Asia, and overthrew Darius in the plains of Arbela, all historians extend its duration to the period we are speaking of. But, after that defeat, the sovereignty of Asia, passing from the Persians to the Macedonians, here begins the third great empire, which continued under Alexander and his successors. The same reasons induced us to lengthen out the times of the Macedonian greatness, to the defeat of Perseus, by Paulus Æmilius; for, though the Romans had long before given laws to Greece, and even to the kings of Macedon, yet that kingdom was not

utterly destroyed till the time of the above overthrow, when, becoming a province of the Roman empire, all the power and dominion that had formerly belonged to it was transferred to the conquerors, and Rome thereby advanced to the sovereignty of the world. Thus, we have a regular succession of empires, establishing themselves one upon the ruins of the other; and, being now arrived at the last and greatest, we shall trace it in its progress and gradual advancement, which will compleat the plan of ancient history, and furnish such a view of past times as may be sufficient for enabling the reader to pursue the train of ages in an exact connected series.

Twelfth epocha.—The Defeat of Perseus.

In the 4546th year of the Julian period, which answers to the 586th year of Rome, and 168th before Christ, Paulus Æmilius having vanquished Perseus, and reduced his kingdom to the form of a Roman province, the Macedonian empire ceased, and that of Rome succeeded
3836 in its stead. The consul, Æmilius, was honoured with a splendid triumph; and the Romans, who were now masters of all Greece, began to think themselves more nearly interested in the affairs of Asia.
3840 Antiochus Epiphanes dying, his son, Antiochus Eupator, a minor of nine years old, succeeded, under the tuition of Lysias. Demetrius Soter, the rightful heir, was then an hostage at Rome, but could not obtain leave of the senate to go and take possession of the kingdom, it being judged more for the advantage of the Romans to have a boy reign in Syria, than a grown man, of mature understanding, as Demetrius then was. Under Antiochus Eupator, the persecution of the Jews still continuing, Judas Maccabeus set himself to oppose it, and signalized his valour by the many victories he obtained over the Syrians. Meantime, Demetrius Soter, escaping from Rome, is acknowledged by the Syrians for their king, and young Antiochus, with his governor, Lysias, slain. This, however, made no alteration with regard to the Jews; they were still persecuted as before, and Demetrius sending numerous armies, one after another, against them, they were all

severally defeated by Judas; but being at length overpowered by the multitude of his enemies, he 3843 was slain fighting with astonishing bravery. His brother Jonathan succeeded in the charge of defending the Jews; and no less distinguished himself by his valour, and a firmness that no misfortunes were able to shake. The Romans, pleased to see the kings of Syria humbled, readily granted the Jews their protection, and declared them their friends and allies. Alexander Balas, pretending to be the son of Antiochus Epiphanes, and supported by Ptolemy Philometor, king of Egypt, claimed the throne of Syria; and, having slain Demetrius, got 3855 possession of the kingdom. The Carthaginians, who had now recovered in some measure the great losses sustained during the second Punic war, could not, by all their submissions, ward off the jealousy of the Romans; who, still dreading the power of that warlike republic, declared war against it, with a resolution of destroying it utterly, that they might rid themselves for ever of so formidable a rival. In Syria, Demetrius Nicator, the son of Demetrius Soter, setting himself to recover his father's kingdom, vanquished Alexander Balas in battle, and got possession of the throne. This same year was 3858 rendered famous by the destruction of two celebrated cities, Carthage and Corinth. The former was taken by Scipio Emilianus, after a war of three years, who thereby confirmed the surname of Africanus in his family, and revived the glory of the great Scipio, his grandfather. Corinth was reduced to ashes by L. Mummius, the consul, and with it ended the famous Achean league. This confederacy, in defence of liberty, had some time before risen to great renown, by the valour and abilities of Philopœmon, one of the most renowned generals that Greece ever produced. And, indeed, after him, we read of no other of that nation who distinguished himself by any eminent accomplishments; which made the hero we are speaking of, to be stiled, as Plutarch tells us, *The last of the Greeks.* After his death, the Achean league no more supported itself with the same reputation as formerly; and the Romans growing jealous of it, it was this year, as we have seen, dissolved, by the destruction of Corinth. All the famous statues, paintings, and other curious works of art, wherewith that city had been so richly adorned, being upon this occasion transported to Rome, these masters of the world,

who had hitherto boasted of no other knowledge than that of war, politics, and agriculture, began henceforth to value themselves upon a polite taste, and the relish of what was excellent in the fine arts. Thus, learning became honourable at Rome; the liberal sciences were encouraged; and such advances were made in all the various branches of knowledge, that we shall see the Augustan age no less distinguished by the productions of the men of genius, than by the exploits and bravery of the many heroes wherewith it abounded. Syria, in the mean time, was the scene of new revolutions. Antiochus Theos, the son of Alexander Balas, under the tuition of Diodotus Tryphon, dethroned Demetrius Nicator, who, by his ill conduct in the government, had incurred the hatred of his subjects. He recovered his authority, however, soon after, and
3861 declared Judea a free and independent state, in consideration of the services he had received from Simon, the brother and successor of Jonathan. By this grant, Simon was constituted high-priest and sovereign prince of the Jews; the land released from all taxes, tolls, and tributes; and every thing that bore the stamp of a foreign yoke being abolished, Judea henceforth became a distinct kingdom, under princes of its own. About this time, the empire of the Parthians began to grow formidable, by the victories of Mithridates; who, having subdued India and Bactria, was advancing with an army towards the Euphrates, to push his conquests on that side. Whereupon, the inhabitants of those parts, calling in Demetrius Nicator to their assistance, he conceived the design of again reducing the Parthians, whom the Syrians still regarded as rebels. He obtained many victories over Mithridates; but preparing to return into Syria, to chastise Tryphon, who, after murdering Antiochus Theos, had himself usurped the crown, he unfortunately fell into an ambuscade, and was made prisoner by the Parthians. Tryphon, who thought himself secure by this disaster of his adversary, was suddenly abandoned by his subjects, to whom he had rendered himself insupportable by his pride. As Demetrius was still a prisoner in Parthia, and his children, by Cleopatra, were under age, it was necessary to look out for a protector; and this office naturally fell to the share of Antiochus Sidetes, the brother of Demetrius. But Cleopatra stopt not here; for understanding that Ni-

cator had married Roduguna, the daughter of Phraates, who had succeeded Mithridates, in the throne of Parthia, she, out of revenge, made Antiochus Sidetes her husband. When he had settled himself in the kingdom, and put an end to the usurpation of Tryphon, he entered upon a war with the Parthians, under 3873 pretence of delivering his captive brother. At first he had full success, overthrew Phraates in three battles, and recovered Babylon, Media, and the other eastern provinces, formerly belonging to the Syrian kings, Parthia only excepted, where Phraates was reduced within the narrow limits of the first Parthian kingdom. The Parthian monarch, not discouraged by these losses, watched the opportunity of the Syrian's army going into winter-quarters, where, being obliged to disperse all over the country, by reason of their great numbers, he fell upon them unexpectedly; and advancing against Antiochus, who was hastening with the forces about him to help the quarters that lay next him, he overpowered him with numbers, slew him and all his followers; and, pushing his advantage, made so dreadful a slaughter, that there scarce returned a man into Syria, of all this numerous army, to carry thither the mournful news of so terrible an overthrow. In the interim, Demetrius was returned into Syria, and on his brother's death there, again recovered the kingdom. For Phraates, after being thrice vanquished by Antiochus, had released him from his captivity, and sent him back into Syria; hoping that, by raising troubles there for the recovery of his crown, he might force Antiochus to return for the suppressing of them; but, on the obtaining of this victory, he sent a party of horse to bring him back again. Demetrius, being aware hereof, made such haste, that he was gotten over the Euphrates into Syria, before these forces could reach the borders of that country; and by this means again recovered his kingdom. But he was soon dispossessed by Alexander Zebina, the son of Balas, who was in his turn van- 3880 quished and expelled by Antiochus Gryphus. The succession of the kings of Syria being very perplexed by reason of the intestine divisions of that kingdom, and the many different pretenders to the crown, has obliged us to be somewhat particular in their history, to prevent confusion. Let us now turn our eyes towards the Romans,

whom we find engaged in a war with the Numantines in Spain, and so often defeated, that they were obliged to send Scipio Æmilianus, as their last resource and hope, before they could subdue that warlike people.
3871 They were also about the same time in no small
danger of an insurrection of their own slaves in Sicily, under Eunus, insomuch that they were obliged to employ the whole forces of the republic against them. Attalus, king of Pergamus, dying, left the Romans heirs to his immense wealth; who, not satisfied with the dominion of Italy, Greece, and Africa, were now beginning to extend their conquests beyond the Alps, where Sextius, having subdued the Salluvians, established the first Roman colony at Aix, in Provence. Fabius defeated the Allobrogians; and Narbonese Gaul was reduced into the form of a province. But, though the republic was thus enlarging her territories abroad, she was far from enjoying that domestic tranquillity, which makes the security and strength of a state. The avarice, usurpation, and ambition of the Patricians had encroached so far upon the properties and privileges of the people, that they stood in need of new defenders to save them from absolute ruin. The two Gracchi, who generously undertook that office, being overpowered by the faction of the nobility, perished in the glorious attempt. After them, few tribunes were possessed of that noble spirit of liberty, which hitherto makes so eminent a part of the character of this brave people. Faction, bribery, and corruption, began to prevail universally among them, and we shall soon see these
conquerors of the world themselves made slaves to
3886 the worst of tyrants. Jugurtha, king of Numidia,
infamous by the murder of his brothers, who had been left under the protection of the Romans, defended himself a long time, more by his largesses than by arms. Marius was, at length, sent against him; and, having put an end to that troublesome war, signalized himself next by the defeat of the Teutones and Cimbri, who threatened
all the provinces of the Roman empire, and even
3904 Italy itself, with destruction. No sooner were
these enemies quelled, than a new and more formidable one arose in Mithridates, king of Pontus, who, having made himself master of all Asia Minor, passed into Greece, and was not without great difficulty driven thence.

by Sylla. Meanwhile, Italy, habituated to arms, and exercised in war, endangered the Roman empire by
an universal revolt: and, to add to all those cala- 3013
mities, Rome saw herself at the same time torn by
the factions of Marius and Sylla; one of whom had, by his victories, spread his fame to the remotest quarters of the north and south, and the other signalized himself as the conqueror of Greece and Asia. Sylla, styled the Fortunate, was but too much so against his country, over which he assumed a tyrannic sway, and laid the foundation of all the ensuing troubles, by the unhappy
precedent of his perpetual dictatorship. Every one, 3025
in his turn, aimed at dominion. Sertorius, a zea-
lous partizan of Marius, fixed himself in Spain, and entered into a treaty with Mithridates. It was in vain to think
of opposing force to a general of his reputation and
experience: and Pompey himself could no other- 3031
wise master him, than by introducing dissentions
among his followers. Rome found a yet more formidable enemy in Spartacus, the Gladiator, who brought her to the very brink of ruin, and was found invincible till the great Pompey was sent against him. Lucullus, in the
mean time, made the Roman arms to triumph in the 3036
East. Mithridates was beaten in every encounter,
and, retiring beyond the Euphrates, found himself still pressed and pursued by his victorious enemy. But this general, invincible in battle, found it impossible to retain the soldiers in obedience, and repress that licentiousness, which, like a phrensy, seized the whole Roman army. Mithridates, not discouraged by his many defeats, was again preparing to make head against his enemies; and Pompey, the last hope and refuge of the Romans, was thought alone capable of terminating this long and destructive war. It was on this occasion that his glory rose to the highest; he finally subdued this valiant and politic prince, reduced Armenia, whither he had fled for refuge;
and, pursuing his advantage, added Albania, Ibe- 3041
ria, Syria, and Judea, to the Roman empire. While
Pompey was thus employed in gathering laurels in the East, Cicero was intent on crushing a dangerous conspiracy at home. That renowned orator, who had laid out so much of his time in the study of eloquence, found now a glorious opportunity of exerting it in defence of his

country; and by it, more than by the arms of his colleague, Antony, were the dark and dangerous machinations of Cataline, defeated. Could Rome have been saved from slavery, the eloquence of Cicero, and the virtue of Cato, those intrepid defenders of liberty and the laws, seemed to offer fair for it. But their efforts availed little to save a state that was rushing headlong into ruin; and where luxury, ambition, and avarice, getting universal possession of the minds of men, rendered them insensible to all great and generous designs, and wholly stifled the noble spirit of freedom. Pompey reigned without a rival in the senate, and his great authority and power made him absolute master of all its deliberations. Cæsar, by his victories in Gaul, was endeavouring to get himself a name and interest that might bring him upon a level with Pompey and Crassus. These three, combining in the design to oppress their country, governed with absolute authority; and Cicero, whose eloquence and zeal for liberty, gave them umbrage, was banished that city he had so lately saved from utter ruin. In the mean time, Crassus, being bent upon an expedition against the Parthians, had the misfortune to be cut off with his whole army; a loss by so much the more fatal to the Roman state, as it was chiefly by him that the rival factions of Cæsar and
3955 Pompey were kept united. His death was followed by a bloody civil war; and Rome lost her liberty for ever in the plains of Pharsalia. Cæsar, victorious, and now master of the universe, traversed with incredible expedition almost all the countries of the known world. Egypt, Asia, Mauritania, Spain, &c. beheld this mighty conqueror triumphing over all his opposers. Brutus and Cassius, animated by a zeal for liberty, en-
3961 deavoured to rescue their country from slavery, by killing the usurper; and the eloquence of Cicero, seconding the glorious design, gave at first some hopes that Rome might yet see better days. But it was the fate of that unhappy city to fall soon after into the hands of Antony, Lepidus, and young Octavius, who by their bloody proscriptions, almost totally extirpated the Roman nobility. Even Cicero, whose credit with the senate had chiefly contributed to the advancement of Octavius, was abandoned by that ungrateful monster to the resentment of Antony, his implacable enemy. In the division of the

empire, Italy and Rome fell to the share of Octavius; who, affecting to govern with great clemency and moderation, endeavoured to throw the odium of all the late cruelties upon his colleagues. In fine, Brutus and Cassius, the last refuge of the republic, both falling in the battle of Philippi, Rome, after them, never made so much as an effort for the recovery of her liberty, but quietly submitted to the dominion of the conquerors. They did not,
however, remain long united. Antony and Cæsar, 3973
combining to ruin Lepidus, turned next their arms
one against the other. The battle of Actium decided the empire of the world in favour of Cæsar; for Antony, upon that disaster, was abandoned by all his friends, and even by his beloved Cleopatra, for whose sake he had brought all these misfortunes upon himself. Herod, the Idumean, who owed his all to that general, was constrained to submit to the conqueror, and thereby confirmed himself in the possession of the throne of Judea. Thus did Octavius triumph over all opposition: Alexandria opened its gates to him; Egypt became a Roman province;
Cleopatra, disdaining to adorn the victor's triumph, 3977
ended her days by poison; and Antony, sensible
that he could no longer withstand the power of his adversary, by a voluntary death left Cæsar in the unrivalled possession of the Roman empire. This fortunate prince, under the name of Augustus, with the title of emperor, took possession of the government. Thus was the Roman commonwealth, 727 years after the foundation of that city by Romulus, converted into an absolute monarchy. Augustus now set himself to reform the many abuses that had crept into the state during the wars; and, knowing that the republican spirit of the Romans, though greatly weakened, was not yet altogether broken, he endeavoured, by the mildness and justice of his government, to reconcile his countrymen to that power which it was in vain for them any longer to oppose. With this view, he introduced among them learning and the polite arts, which, by the encouragement they met with from him and Macænas, began to lift up their heads and flourish. Horace, Virgil, Ovid, and Livy, adorned the age we are speaking of, and do it more honour by their inimitable writings than all the victories of the prince under whom they lived. Eloquence alone, of all the branches of literature, lay uncultivated.

That expired with Cicero and the free state; nor need we wonder at it; since liberty, which had hitherto animated the orator, ceasing, the art itself became useless, and was regarded with an eye of jealousy by the men in power. Augustus having, by this wise and politic management, secured the tranquility of Italy and Rome, began to look abroad into the provinces, with a view to check the enemies of the Roman name, who, taking advantage of the intestine divisions of the empire, had committed many outrages. He subdued the Cantabrians and Asturians, bordering upon the Pyrenees: Ethiopia sued for
3980 peace; the Parthians, dreading his power, sent back the standards taken from Crassus, and all the Roman prisoners in their India sought his alliance: Pannonia submitted to his power; and Germany trem-
4004 bled at the name of this mighty conqueror. Victorious every where, both by land and sea, he shut the temple of Janus, and gave peace to all the Roman empire. This happened in the 754th year after the building of Rome, and 4714th of the Julian period, which coincides with the first year of the Christian æra, according to the computation in use in these western parts.

We have now completed our original design, which was to lay before the reader a short view of ancient history, from the creation of the world to the birth of Christ. We have thrown together all the material transactions of the different nations of the world; and, by referring them as near as possible to the years in which they happened, have, we hope, given a pretty distinct notion of the coincident periods of history. By keeping this general plan constantly in mind, we shall be enabled to read either ancient or modern writers upon this subject with all the advantage to ourselves we can desire. For, whether they make choice of a longer or shorter portion of time within which to limit their detail of transactions, or in whatever order different authors occur to our study, the knowledge we have of the general course of ages, and to what part of universal history every particular period belongs, will preserve all our acquisitions unconfused, and enable us to digest our whole treasure of reading under those heads and divisions, to which each part properly refers. Nor is this an advantage to be lightly accounted of, inasmuch as men, according to their different views and aims in life,

find it their interest sometimes to apply themselves more particularly to one part of history, and sometimes to another; in which case nothing is more useful, than such a general view of things as shall enable them to connect and tie together those several parts of knowledge which interest or necessity has at different times added to their stock of learning. This is so evident, that we need not enlarge upon it; and therefore, having now finished all we intended on this part, we shall here conclude the head of history and chronology.

CHAP. X.

HISTORY OF ENGLAND.

A Description of the Ancient State of Britain.

THE ancient state of England is but little known before the Romans were in possession of it; but it appears that the first inhabitants were very barbarous and uncultivated. The Romans describe the Ancient Britons as a plain, simple, unlettered people, divided into a number of small and independent states, and each state governed by a chief magistrate, or king. The Druids were the only learned men among them. The inland inhabitants are represented as extremely numerous, living in huts or cottages, thatched with straw, and feeding large herds of cattle. They subsisted chiefly upon milk, fruits, and flesh procured by the chace; what cloathing they had, usually consisted of skins of animals, but a great part of their bodies, their legs and thighs, arms and shoulders, were naked, and painted of divers colours, and their hair hung down their backs. The dress of savage nations is every where almost the same.

Their forces consisted chiefly of infantry; but they had

a considerable cavalry, which they could bring into the field upon extraordinary occasions. They likewise used chariots in battle, which they managed with great dexterity; being armed with scythes, fastened to the end of the axle-trees, inflicting terrible wounds, and spreading terror and devastation wheresoever they drove: the chieftains managed the reins, while their dependents fought from the chariot.

The religion of the ancient Britons was one of the most considerable parts of their government; and the Druids, who were priests or ministers of the most distinguished order, were the guardians of it, and had the management both of justice and religious rites; these likewise exercised an unlimited influence over the rude multitude, who revered them as beings more than mortal. They possessed the right of making laws, and of explaining and putting them in execution. They were considered as the interpreters of the gods; and the austerities of their manners, the simplicity of their lives, with the honours of their birth, joined to those of their functions, procured them the highest veneration among the people. They chiefly resided in groves of oak, where they celebrated their solemnities; and they were exempted from all taxes, and military services, as their persons were held sacred.

The religious principles of the Druids are thought to have been similar to the Magi of Persia, and the Chaldeans of Assyria; therefore, to have been derived from the same original. Their religious tenets teemed with the grossest superstitions. They inculcated the Pythagorean doctrine of transmigration of souls into other bodies, as well as many other strange things, which are now but very imperfectly known; as they never suffered their learning to be committed to writing, that the vulgar should not become acquainted with it.

On solemn occasions, they sacrificed human victims, which they burnt, in large wicker *idols* or *images*, made of osiers, and filled with living men; they then set fire to the images, and burnt these miserable creatures, as an offering to their deities.

There were two classes of men among the Druids, which were highly respected; the one called *bards*, to which were intrusted the education of youth, and whose business it was likewise to compose verses in commemoration of their heroes and other eminent persons, and to furnish

songs upon public occasions, which they sung to the sound of harps; the other had the name of *prophets*, who regulated all public affairs, directed and put in order all public sacrifices and religious ceremonies, and foretold future events. They were under a principal, elected by themselves, called the *Arch-Druid*; in whom was invested supreme authority. The Druids being the national preceptors, it is natural to suppose that the inhabitants took a tincture from the discipline of their teachers, as their superstition continued, and prevailed long after the introduction of Christianity.

Several circles of stones are to be seen in different parts of the kingdom, which go by the name of *Druid Temples*, of which Stone-henge, in Wiltshire is the most remarkable. Abury, in the same county, was also a signal monument of this kind; and Rollright, in Oxfordshire, and various other remains of these temples are still in existence in various parts of the kingdom.

Its Invasion by the Romans, &c.

THE Britons had long remained in this rude and independent state, when Cæsar, having over-run Gaul (since called France) with his victories, remained there inactive with a powerful army. Being willing still farther to extend his fame, he determined upon the conquest of South-Britain: a country that seemed to promise an easy triumph, as he had previously gained every requisite intelligence from the masters of trading vessels, who brought tin and other commodities from this country to Gaul.

He landed, after a sharp conflict, at Deal, eight miles from Dover (54 years before Christ); and soon obliged the Britons to submit to the Roman arms. They were compelled to accept Cæsar's terms of peace, and agreed to deliver up hostages, as a token of their submission to the Roman republic.

As soon as the inhabitants of the whole country heard of the sudden invasion and compulsive truce, they brought together such a powerful force, that Cæsar was repulsed, and obliged to retreat to his ships, and set sail for Gaul; but in the following year he returned with a more formidable fleet and army, landed near the same place as before, and encamped on Barham Downs. Several battles were

fought with various successes, till at length Cæsar became victorious, and compelled the Britons to complete their stipulated treaty; and hostages were given for the due performance of it.

In the reign of Vespasian, successor to Nero, the famous Julius Agricola, being appointed governor of Britain, in the space of a few months reduced the whole island to subjection; and it continued to be a Roman province from that era, A. D. 79, to the year 410, when the Romans were obliged to withdraw all their forces to repel the Goths, who had begun to desolate the Roman empire. It was once more left to its ancient inhabitants.

For some time after the Romans left it, Britain was in a state of anarchy. The Scots and Picts ravaged the northern boundaries with impunity. At length, advancing farther, Vortigern was elected governor of South-Britain, but made responsible for his conduct to the magistrates of every county. He obtained the consent of the other states to invite a body of Saxons, a warlike people of Germany, to his assistance. Hengist and Horsa, brothers, were the leaders of the Saxons, who landed on the Isle of Thanet, in Kent, A. D. 449; and Vortigern gave his daughter in marriage to Hengist, with the county of Kent as a dowry.—Hengist and Horsa assisted Vortigern in driving back the Scots and Picts to their own country of North Britain; they then sent for reinforcements from the continent, threw off the mask, and instead of remaining as allies, in a short time became conquerors of one province after another, till at length they became masters of the whole, and established the heptarchy, or the division of South-Britain into seven kingdoms, which were in the following order:

1. The kingdom of Kent, contained the county of Kent, which was founded by Hengist, 455, and ended 823.—— 2. The kingdom of South-Saxons contained the counties of Sussex and Surry: this kingdom was founded by Ella, 491, and ended in 600.—— 3. The kingdom of the West Saxons contained the counties of Cornwall, Devon, Dorset, Somerset, Wilts, Hants, and Berks: this kingdom was founded by Cerdic, 519, and ended 828.——4. The kingdom of East-Saxons contained the counties of Essex, with part of Hertfordshire, and Middlesex: this kingdom was founded by Erchenwin, 527, and ended 827.—— 5. Th-

kingdom of Northumberland contained Yorkshire, Durham, Lancashire, Westmoreland, Cumberland, and Northumberland, and a part of Scotland to the Frith of Forth: this kingdom was founded by Ida, 547, and ended 827. ——6. The kingdom of the East-Angles contained the counties of Suffolk, Norfolk, Cambridge, and the Isle of Ely: this kingdom was founded by Uffa, 575, and ended 792.——7. The kingdom of Mercia contained the counties of Huntingdon, Rutland, Lincoln, Northampton, Leicester, Derby, Nottingham, Oxford, Chester, Salop, Gloucester, Worcester, Stafford, Warwick, Buckingham, Bedford, and Hertford: this kingdom was founded by Creda, 582, and ended 827.

The sovereigns of the seven kingdoms, which had been more than a century in forming, made war upon each other at different times, and weakened each others power so much, that in course of time they brought on a dissolution of the heptarchy.

Egbert, of the race of Cerdic, founder of the kingdom of the West-Saxons, the heptarchy had been reduced to *five* kingdoms, of which his own was the most considerable; and the remaining kingdoms were either *defeated* or *surrendered* to him without opposition. As this totally put an end to the heptarchy, so it laid the foundation of the English monarchy.

England, at different periods, has been under the sovereignty of the Britons, the Romans, the Saxons, or Angles (from whom it derived its names,) the Danes, and the Normans.

Egbert, the first monarch of England, of the Saxon line, ordered the south part of Britain to be called England, and took the title of the King of England: he reigned from 828 to 838.

Ethelwolf, the eldest son of Egbert, succeeded his father in the year 838, and reigned till 857.

Ethelbald, the eldest son of Ethelwolf, succeeded his father, jointly with his brother Ethelbert, in the year 857, and reigned till 860.

Ethelbert, the second son of Ethelwolf, succeeded his brother Ethelbald, as sole monarch of England, in the year 860, and reigned till 866.

Ethelred, the third son of Ethelwolf, succeeded his brother Ethelbert, in the year 866, and reigned till 872.

ALFRED, the fourth son of Ethelwolf, succeeded his brother Ethelred, in the year 872, and died on the 28th of October, 900, in the 28th year of his reign, and was buried at Winchester.

It was Alfred that framed an excellent code of laws for the security of his subjects; which were the groundwork of the present: he divided the kingdom into *shires*, or *counties*, the counties into *hundreds*, and the hundreds into *tithings*.

King Alfred knew too well the value of time to lose any part of it in trifling pursuits, but to make the best of every moment: when he was not engaged in war, of which he had his share, for it is said he fought 56 pitched battles with the Danes, he set apart *eight* hours every day for acts of devotion, *eight* hours to public affairs, and *eight* hours to sleep, study, and necessary refreshment. As clocks and hour-glasses were not yet introduced into England, he measured the time by the means of wax candles, marked with circular lines of divers colours, which served as so many *hour lines*; and to cause them to burn steadily he invented *horn lanthorns*, which were made of pieces of horn scraped thin, and fixed in frames of wood to defend the candles from the wind. Thus lanthorns were the invention of a king.

EDWARD THE ELDER, the eldest son of Alfred, succeeded his father in the year 900, and reigned till 925.

ATHELSTAN, the eldest son of Edward, succeeded his father in the year 925, and reigned till 941.

EDMUND I. second son of Edward the elder, succeeded his brother Athelstan, in the year 941, and reigned till 948.

EDRED, the next son of Edward the elder, succeeded his brother Edmund, in the year 948, and reigned till 955.

EDWY, the eldest son of Edmund, succeeded his uncle Edred, in the year 955, and reigned till 959.

EDGAR, the second son of Edmund, succeeded his brother Edwy, in the year 959, and reigned till 975.

EDWARD THE MARTYR, the eldest son of Edgar, succeeded his father, in the year 975, and reigned till 979.

ETHELRED II. the second son of Edgar, succeeded his half-brother, Edward the Martyr, in the year 979, and reigned till 1016, nearly 37 years.

EDMUND II. surnamed Ironside, son of Ethelred, succeeded his father, in the year 1016, and reigned only till

1017, having been murdered at Oxford by two of his chamberlains. He left *two* sons and *two* daughters; from the descendants of one of whom, by marriage with Malcolm III. king of Scotland, his present Majesty George III. is descended in a direct line. James VI. of Scotland, I. of England, whom Queen Elizabeth nominated her successor, as being her nearest relation, was a descendant of Malcolm.

CANUTE, son of Sweyn, of the Danish line, succeeded Edmund; though Sweyn had been proclaimed king, in the reign of Ethelred II. by the Danes residing in England, and the English who were disloyal to Ethelred; but as the latter was not deposed, therefore Sweyn is not placed in the list of the kings of England. Canute reigned from the year 1017 to 1035: he made an alliance with Normandy, and married Emma, Ethelred's widow. He died at Shaftesbury in the 10th year of his reign.

HAROLD I. son of Canute by Alfwin, his first wife, succeeded his father in the year 1035, and reigned till 1039.

HARDICANUTE, son of Canute by Queen Emma, the widow of Ethelred II. succeeded his half-brother, Harold I. in the year 1039, and reigned till 1041, and died of a plethory at Lambeth.

EDWARD THE CONFESSOR, youngest son of Ethelred II. married Editha, daughter of Godwin, earl of Kent. He was the first king of England that touched for the disease, now called the *king's-evil*, which was before practised by the French kings. He succeeded Hardicanute in the year 1041, and reigned till 1065. Edward collected the laws made by his predecessors, viz. those of the Danes and Saxons, into one code (begun by Alfred), and called *the common law of England*. He was buried in Westminster abbey, which he rebuilt; and he was considered as a saint by the church, which caused his bones to be enshrined in *gold*, and set with *jewels*, in the year 1206. William, duke of Normandy, paid a visit to Edward in England in 1051; and it is probable he then promised to appoint him his successor (Edward dying without issue), as he detested Har[illegible], who was the son of Godwin, though [illegible] marri[illegible] [illegible]s sister.

HAROLD II. son of Godwin, earl of Kent, succeeded Edward the Confessor, in the year 1065; but William, duke of Normandy, made a claim to the crown as his right, it being bequeathed to him by Edward; and Ha-

rold had made an oath to him, when on a visit in Normandy, to relinquish his own pretensions in his favour. William sent ambassadors to Harold to summon him to resign his crown; but Harold returned him for answer, that he was able to defend his rights against any one who should dispute them with him. This caused William to fit out a strong fleet, and re-inforce his army; with which he crossed the channel, and landed at Pavensey in Sussex on the 29th of September, 1066, and soon after, viz. on the 14th of October, came to an engagement with Harold at Hastings, and defeated his army. Harold was killed upon the spot; and a great many of his soldiers were slain in that memorable battle between the English and the Normans.

William the Conqueror.—*Reigned from* 1066 *to* 1087.

William was the natural son of Robert VI. duke of Normandy. Harold being slain in battle, William marched to London, where he claimed the crown by the testament of King Edward the Confessor. On his way he was met by a large body of the men of Kent, each with a bough of a tree in his hand. This army was headed by Stigard, the archbishop, who made a speech to the Conqueror, in which he boldly demanded the preservation of their liberties, and let him know that they were resolved rather to die than to part with their laws and liberty.

William thought proper to grant their demands, and suffered them to retain their ancient customs.

Upon his coronation, he was sworn to govern by the laws of the realm; and though he introduced some new forms, yet he preserved the trials by juries. He instituted the courts of chancery and exchequer, but disarmed his English subjects, and forbid their having any light in their houses after eight o'clock at night, when a bell was rung, called Curfew, or cover fire, at the sound of which all were obliged to put out their fires and candles. He obliged the Scots to preserve the peace they had broken, compelled the Welsh to pay him tribute, refused himself to pay homage to the Pope, built the Tower of London, and had all public acts made in the Norman tongue. He caused all England to be surveyed, and the men numbered, in a work called Doomsday-book, which is still in being.

To curb the insolence of the French, who had invaded Normandy, and after that to reduce his son Robert, who appeared there in arms against him, he carried over with him an English army, and left his own troops at home. William, in a general engagement, had like to have been killed by his son; but Robert, when he found that he was engaged with his father, dutifully submitted to him, though he was victorious.

William invaded France, and taking Mantes in August 1087, he ordered it to be reduced to ashes; but approached so near the flames, that the heat of the fire, together with the warmth of the season, threw him into a fever, which being increased by a fall from his horse, he died in a village near Roan, in the 61st year of his age, after a reign of 52 years in Normandy, and 21 in England, and was buried at Caen.

In this reign, Richard, the king's second son, was killed by a stag in the New Forest. There was a great fire in London, which consumed St. Paul's; and an earthquake, which happened on a Christmas Day.

WILLIAM II.—*From* 1087 *to* 1100.

WILLIAM the Second, son of William the Conqueror, who was from the colour of his hair surnamed Rufus, or Red, succeeded; and at the same time his brother Robert succeeded to the duchy of Normandy. Robert resolved to assert his right to the crown of England, and several of the Norman nobility espoused his cause; but William put an end to the rebellion, by defeating a body of troops in Kent, and soon after obliged his brother to conclude a peace. The two brothers then made war on their younger brother, Henry, whom they besieged in Mount St. Michael; where William, one morning riding out unattended, fell in with a party of Henry's soldiers, and endeavoured to force his way through them, but was dismounted, and a soldier was going to dispatch him, when he cried out, "Hold, fellow, I am the king of England." On this the man, dropping his sword, raised the monarch from the ground, and received from him the honour of knighthood. The brothers were soon reconciled; and William turned his arms against Scotland, and defeated the army of their King Malcolm. Soon after, Robert de Mowbray, finding that the king had neglected to reward his services, joined with several other noblemen to

set the crown on the head of Stephen, grandson to William the Conqueror; upon which the king marched into Yorkshire, reduced Bamborough Castle, took Mowbray prisoner, and put an end to the rebellion.

At length, as William was hunting in the New Forest, he was slain with an arrow shot by Walter Tyrrell, his particular favourite, who, aiming at a deer, struck the king full in the breast; and he immediately expired, on the 2d of August, 1100, aged 44, after a reign of 13 years, and was conveyed to Winchester in a collier's cart.

HENRY I.—*From* 1100 *to* 1135.

THIS prince, the youngest son of William the Conqueror, was, on account of his great learning, surnamed Beauclerc. He was born at Selby, in Yorkshire, in 1070; and the English, looking upon him as their natural prince, raised him to the throne in 1100, though his eldest brother Robert was living, but he was engaged in the Holy Land. Henry had before shewn himself a politic and brave prince. He was no sooner seated on the throne, than he began to amend the laws, and to abolish some abuses in the church. About this time, Robert returning from Jerusalem, Henry endeavoured to secure himself on the throne by marrying the Princess Matilda, daughter to Malcolm, king of Scotland.

Duke Robert, however, being determined to revive his claim, landed at Portsmouth in 1102; but a treaty was proposed to save the effusion of blood; and it was agreed, that Henry should retain his kingdom, relinquish to Robert the possession of Normandy, and pay him 3000 marks a year. Robert afterwards, being disturbed by an insurrection, and having mortgaged all Normandy, except the city of Roan, to pay his debts, applied to his brother for assistance; on which Henry levied an army, passed into Normandy, seized several cities, and, on his return to England, was followed by his brother as a suppliant to a conqueror for mercy, but Henry was deaf to all his entreaties; on which Robert returned, and obtained the assistance of France, and some of the neighbouring princes; but Henry, going with an army to Normandy, totally defeated the allies, took the duke himself prisoner, seized upon his dominions, and confined him in Cardiff Castle, Wales. Some time after, Henry's only son, William, and the Countess of Perche, his natural daughter, in their pas-

sage by sea from Barfleur to England, were drowned; which gave Henry deep affliction. His brother Robert, after a confinement of 27 years, died in prison, and his death was soon followed by that of Henry. He died on the 1st of December, 1135, in the 68th year of his age, and was buried at Reading. The Empress Maud was his only legitimate child then living, though he had twelve natural children.

Henry was very learned, and had so great a regard for the sciences, that he built a palace at Oxford, whither he often retired. In his reign, Winchester, Gloucester, and Worcester were burnt; the Thames, Medway, and Trent were almost dried up. In the 33d year of his reign, London was burnt from Westcheap to Aldgate.

STEPHEN.—*From* 1135 *to* 1154.

THE Norman government, which had subsisted sixty-nine years in England, was now extinct. The Empress Maud, or Matilda, succeeded her father William in his duchy of Normandy; but though her right to the crown of England had been recognised in parliament, Stephen, earl of Bologne, the third son of the earl of Blois, by Adela, daughter to William the Conqueror, got possession of the throne, and was crowned on the 22d of December, 1135. Stephen revived the favourite laws of Edward the Confessor. In this reign, the insolence of the clergy obliged Stephen to seize the castles belonging to the bishops of Salisbury, Lincoln, and Ely. The spirit of rebellion upon this occasion prevailed, and the Empress Maud seized the opportunity of asserting, in person, a right to the crown. The king besieged the empress in Wallingford, pursued her to Lincoln, and gave battle to the earl of Gloucester before that city, when the king was taken prisoner; before which he had broken his battle axe and sword, and was knocked down on his knees with a stone. He was then confined in irons in Windsor Castle.

Maud was now acknowledged sovereign, but behaved with great haughtiness. King Stephen's consort humbly entreated her to set her husband at liberty, promising that he should resign his crown, and end his days in a monastery; but she dismissed her with such contempt, that the late queen, recovering resolution, raised a large body of forces; and Maud refusing to mitigate the severity of the Norman laws, a revolt ensued, and the king

was set at liberty. All the adherents to Maud were at length obliged to retire to Normandy: however, the young Prince Henry, her son, obtaining assistance from France, returned to England; but when both princes were preparing for battle, a truce was agreed on, and it was stipulated that the king should enjoy the crown during life, and that after his decease Henry should succeed to the throne. Stephen died on the 25th of October, at Canterbury, in the 50th year of his age, and in the 19th of his reign, and was buried in the abbey of Feversham, in Kent.

In this reign there was a great fire in London; the city of York was burnt to the ground; Rochester was also burnt to the ground.

Henry II.—*From* 1154 *to* 1189.

Henry Plantagenet, the son of the Empress Maud, by Geoffrey, earl of Anjou, was crowned in 1154, in the 23d year of his age. In 1160, Henry concluded a marriage between his eldest son and Margaret, the daughter of the French king, though the young prince was only five years of age, and the princess but six months old. The duke of Brittany also gave his daughter Constance in marriage to Geoffrey, another of Henry's sons, then in his cradle.

Henry was disturbed at home by the arrogance of Thomas Becket, whom he had raised from a mean degree to the see of Canterbury, and the dignity of high chancellor. The dispute ran so high, that the archbishop was obliged to fly the kingdom. The affair, however, being at length determined, Becket returned, and raised such disturbances, that four knights, thinking to please the king, murdered him in his cathedral of Canterbury. This prelate was afterwards honoured with the title of a martyr, and canonized by the title of St. Thomas of Canterbury.

Henry sailed with a numerous fleet to Ireland, and landing at Waterford on the 18th of October, 1172, all the Irish princes swore allegiance to him; so that he divided great part of the country among the English nobles, &c. who attended him in the expedition; from whom sprung the principal families now in Ireland. The same year, the pope's legate prevailed on the king to do penance, by going barefoot three miles to Becket's shrine; and to be scourged by the Augustine monks, who gave him fourscore lashes on the naked back.

Henry met with great vexation in his own family: Eleanor, his queen, being jealous of Rosamond, the Lord Clifford's daughter, found means to dispatch her by poison; and the young princes, his sons, raised a great rebellion, in conjunction with the king of Scotland, whom Henry took prisoner, but restored the young princes to favour, and pardoned all the revolters; obliging the king of Scotland to pay him homage for his kingdom.

Henry was so mortified at the disobedience of his sons, that through grief he fell sick at Chinon, in Touraine, and, perceiving his end draw near, gave orders for his being carried into the church, where he expired before the altar, on the 6th of July, 1189, in the 57th year of his age, and the 35th of his reign. He was stripped by his domestics, and left quite naked in the church; but was afterwards buried at Fonteveraud, in Anjou.

In his reign lions were first kept in the Tower of London; London Bridge was rebuilt with timber; there was an earthquake; by which the church of Lincoln and several others were destroyed.

RICHARD I.—*From* 1189 *to* 1199.

RICHARD, the eldest son of Henry II., who was from his bravery surnamed Cœur de Lion, or Lion-hearted, was 32 years of age when his father died. He was crowned in Westminster Abbey on the 3d of September, 1189; at which time the Jews of London flocking to make presents to him, the mob robbed and murdered all they met with. At York, 500 Jews, besides women and children, shut themselves up in the castle, and there died by their own hands, rather than submit to their persecutions.

Richard had no sooner ascended the throne, than he went to the Holy War, in conjunction with Philip, king of France. Richard, being driven by contrary winds to the isle of Cyprus, landed his troops there, and took Isaac, the king of that island, and his daughter, prisoners; conquered the whole country, was made king, and afterwards transferred his right to that island to Guy Lusignan, titular king of Jerusalem, in exchange for that empty title.

In the absence of Richard, which lasted four years, Prince John, his brother, usurped the sovereign author-

ty; but the king soon suppressed his brother's party, levied a numerous army, and invaded France; and at the battle of Blois, Richard took all the archives of the French kingdom. After which he was preparing to return to England, when a gentleman of Limosin, having discovered a treasure upon his estate, the king claimed it as sovereign of Guienne: the gentleman took shelter in the castle of Chaluz, which the king besieged; in reconnoitring the walls, he received a wound, of which he died on the 6th of April, 1199, aged 42, after a reign of nine years and nine months. The castle being taken before the king died, he ordered all the garrison to be hanged, but pardoned the man who wounded him.

He appointed, by will, his brother John to succeed him in all his dominions.

JOHN.—*From* 1199 *to* 1216.

JOHN, surnamed Lackland, the brother of Richard, ascended the throne in 1199. Though Arthur, duke of Brittany, son of Geoffrey, the late king's brother, had the hereditary right; yet John was elected king, on condition that he should restore and establish the rights of the people. He was then 32 years of age; and having seized the duchy of Normandy, he left Arthur only the possession of some of the provinces enjoyed by the English in France.

John had several contests with the Pope, who had excommunicated him, and absolved the people of England from their oath of allegiance, and now sent Pandulph, his nuncio, into England, who offered him the Pope's protection, on condition of his taking an oath to obey the pontiff in all things, and resign the crown into the hands of the nuncio. To this John consented, repaired to Dover church, and in the presence of the people took off his crown, disrobed himself of all the ensigns of royalty, and laid them at the feet of the nuncio, who was seated on a throne: after which he signed a charter, whereby he resigned the kingdom of England and the lordship of Ireland to the holy see, and bound himself as a vassal to pay 700 marks annually for England, and 300 for Ireland, and then did homage to the Pope in the person of his nuncio, who kept the crown and sceptre five days in his possession.

The English barons, fired with indignation at this meanness, had recourse to arms, and demanded a re-establishment of the laws of Edward the Confessor, and a renewal of the charter of Henry the First; which being refused by the king, they elected Robert Fitzwalter for their general, entered London, and besieged him in the Tower. The king complied, when he could no longer resist, and agreed to meet the barons between Staines and Windsor, and there granted whatever they desired; and hence arose the famous charter of liberties, called Magna Charta, which he was obliged to sign, and also the charter of the Liberties of the Forest, which have been since esteemed the foundation of the English liberties. The king, however, though he had ratified these charters with a solemn oath, brought over an army from Flanders, and ravaged the whole kingdom: upon this the barons applied for assistance from the king of France, promising the crown to his son Lewis, if he freed them from John's tyranny. Lewis soon came to their assistance, landed at Sandwich, and took Rochester; while John retired to Winchester, having prevailed on the Pope to excommunicate both the French king and the English barons; but being deserted by some of his mercenaries, the dauphin besieged Dover, while the barons invested Windsor. At length grief and fatigue threw the king into a fever. He died on the 18th of October, 1216, in the 51st year of his age, and the 17th of his reign.

In this reign London Bridge, which was before of wood, was built entirely of stone.

HENRY III.—*From* 1216 *to* 1272.

HENRY of Winchester was but 12 years of age, when the earl of Pembroke had him crowned at Gloucester, October 28, 1216; and the legate caused him to do homage to the holy see. Many of the barons who had sworn allegiance to the dauphin joined with Henry, and the Pope renewed his excommunication against Lewis: after this a truce was concluded, and prolonged till Easter; soon after which the French laid siege to Lincoln castle, but being unsuccessful in that and some other attempts, Lewis agreed to return home, and to restore the English dominions in France.

Henry began his majority with exacting large sums, and annulling the two sacred charters granted by his fa-

ther. He landed in Brittany with a numerous army, and then spending his time with diversions, shamefully returned, after he had spent all his treasure. He afterwads renewed the war, in which he lost all Poictou, and then concluded a truce with Lewis for five years, to purchase which Henry consented to pay him 5000l. annually.

The king met with many mortifications from his parliament and people, who at length obliged him to renew the two charters, which was done in Westminster-hall, in the following manner, viz. the peers being assembled in the presence of the king, each holding a lighted taper, the archbishop of Canterbury denounced a terrible curse against those who should violate the laws, or alter the constitution of the kingdom; then the charter was read aloud, and confirmed by the king, who all this while kept his hand upon his breast; after which every one threw his taper on the ground to raise a great smoke, and wished *that those who violated the charters might smoke in hell.* After which, the parliament granted him a subsidy for suppressing an insurrection in Guienne. He soon reduced that province, and returned to England, where he renewed his exactions. Prince Richard, Henry's brother, being elected king of the Romans, took the immense sum of 700,000l. into Germany to support his election; while the king amassed 950,000 marks for an expedition to the Two Sicilies, which were offered him by the Pope, though the crown belonged to Conradin, the Emperor Conradin's son. In short, the people were grievously oppressed; and the barons, finding that Henry could not be bound by the most solemn oaths, undertook to reform the government: accordingly commissioners were chosen by the king and the barons, and articles agreed on, which the king again broke. At last, they came to an open war, when a decisive battle was fought near Lewes, in Sussex, in which the king's army was defeated, and himself, Prince Edward, and the king of the Romans, taken prisoners; but afterwards the earls of Leicester and Glocester quarrelling, the latter joined Prince Edward, who had escaped from his keepers, and, uniting their forces, marched against the earl of Leicester, whom they defeated and slew. The king was set at liberty, but peace was not restored till some time after, when Prince Edward engaged in a crusade, and went to the Holy Land.

Henry died at London, November 20, 1272, aged 65, in the 56th year of his reign, and was buried in Westminster abbey.

EDWARD I.—*From* 1272 *to* 1307.

EDWARD, surnamed Longshanks, was aged 33 when his father died, and was crowned on his return from Palestine, where, with only 10,000 Englishmen, he struck a general panic into the Saracens. He narrowly escaped being murdered there by an assassin, from whom he received a wound in his arm, which was given by a poisoned dagger; and it is affirmed that he owed his life to the affection of Eleanor his wife, who was with him, and sucked the venom out of the wound. He arrived in England, with his faithful queen, on the 25th of July, 1274; and they were both crowned at Westminster, on the 19th of August following. He began his reign with a strict enquiry into the affairs of his kingdom, &c. and confirmed the great charter.

He then set about rectifying the coin, which had been so much adulterated by the Jews, and caused 280 of them to be put to death.

Edward, having defeated and killed Lewellyn, a petty king of Wales, who had revolted, afterwards summoned a parliament at Ruthen, where it was resolved that Wales should be inseparably united to England. But some of the Welch nobles telling the king that he would never peaceably enjoy their country till they were governed by a prince of their own nation, he sent for his queen, who was then pregnant, to lie in at Caernarvon, where she was brought to bed of a prince, whom the states of Wales acknowledged for their sovereign; and since that time the eldest sons of the kings of England have borne the title of Prince of Wales. Edward banished 15,000 Jews for usury and adulterating the coin. Soon after this, Queen Eleanor died at Grantham, in Lincolnshire; to whose memory the king erected a cross at every place where the corpse rested in the way to Westminster.

Edward carried his arms into Scotland, where he took the three important places of Berwick, Dunbar, and Edinburgh. John Baliol, their king, who was supported by Edward, repaired to him in the most humble manner, renewed the oath of fealty, and put the whole kingdom in his power While Edward was in Flanders, endeavour

ing to recover some dominions he had lost in France by treachery, William Wallace, the glory of Scotland, rose up in the defence of his country, and having suddenly dispossessed the English of all the strong places they held, was declared regent of the kingdom; on which Edward hastily returned from France, advanced into Scotland at the head of a powerful army, and defeated Wallace, who several years after was betrayed into the hands of the English, and sent to London, where Edward treated him with unpardonable severity, and made this great hero suffer the death of a traitor. Edward thrice conquered Scotland, and at length vowed that he would destroy that kingdom from sea to sea; but was seized with a dysentery, and died in the little town of Burgh on the 7th of July, 1307, in the 68th year of his age, and the 35th of his reign. His body was interred in Westminster abbey.

Edward was a head taller than the generality of men; his person was well made, strong, and handsome; but his legs being rather too long, he was thence called Longshanks. His regard for the laws was so great, that he publicly imprisoned the prince of Wales, his son, for breaking into the park of the bishop of Litchfield and Coventry.

EDWARD II.—*From* 1307 *to* 1327.

EDWARD of Caernarvon was twenty three years of age when his father died. He recalled Prince Gaveston, whom his father had banished, and by his will enjoined him not to associate with; and then married Isabella, the daughter of the French king; and they were both crowned at Westminster on the 24th of February, 1308. His ridiculous fondness for Gaveston created innumerable disputes. At length, the barons had recourse to arms, and Gaveston was beheaded. Meanwhile the Scots gained three victories over the English, and made themselves masters of every place in Scotland.

King Edward now raised the two Spencers, father and son, to the summit of power; but they were banished by the parliament. The king levied an army, took some castles from the barons, and recalled the Spencers. Edward afterwards invaded Scotland, but, wanting provisions, returned without striking a blow; on which Bruce, king of Scotland, pursued him to York, destroyed 20,000 of the English, and then consented to a peace.

The two Spencers incurred the general hatred; and Queen Isabella fled to France with her son, whence the nobility sent for her, and she, with a numerous army, marching towards London, the king fled into the West; but she still pursuing him, he set sail for Ireland, but was driven back into Wales. Hugh Spencer, the father, being taken, was, without a trial, hanged and quartered, and the king himself was sent prisoner to the queen, and the young Spencer was hanged.

The queen now forgot every call of nature and duty, and was entirely governed by Mortimer, whom she took to her bed. King Edward was deposed, and the son proclaimed king; they having obliged the old king to resign in the 43d year of his age, and the 20th of his reign; after which he was treated with the greatest indignities, and at last cruelly murdered; for some assassins covered him with a feather-bed, and held him down, while others thrust a horn-pipe up his body, through which they conveyed a red-hot iron, and burnt his bowels to prevent any external appearance of violence.

EDWARD III.—*From* 1327 *to* 1377.

EDWARD of Windsor was crowned at the age of 14, on the 26th of January, 1327. Though the parliament appointed a regency, the queen and Roger Mortimer had the sole rule. By their influence, the young king renounced all his pretensions to Scotland, and gave his sister in marriage to David Bruce, king of the Scots; but afterwards becoming sensible of his error, he caused the queen, his mother, to be confined for life, and Mortimer, earl of March, to be hanged at Tyburn. He then broke the truce with Scotland, and invaded that kingdom; won four battles in a short time, and obliged King David to fly with his queen into France, when he set up Edward Baliol in his room. Edward now laid claim to France; for Charles, his mother's brother, dying, Philip of Valois had possessed himself of the kingdom, alleging the Salique law; but Edward asserted that the Salique law, in excluding females from the succession, did not exclude their male issue, on which he grounded his title. His first campaign passed without bloodshed; but he took the title of King of France, and quartered his arms with

the *flower de luce*, adding the motto, *Dieu et mon droit*, or, *God and my right*.

In his second attempt, he defeated the French fleet, destroyed or took 370 of their ships, and 30,000 men; then besieged Tournay; but being called home to oppose the Scots, concluded a truce for one year with King Philip. The next campaign, he wasted all the country up to the walls of Paris, and obtained the glorious battle of Cressy, which was won by the prince of Wales, who was then only sixteen. The French were defeated with incredible slaughter. The king of Bohemia also died in the field; when his standard, on which were, in gold, three ostrich's feathers, with these words, *Ich dien*, that is, *I serve*, was brought to the prince of Wales, who, in memory of that victory, bore the ostrich feathers in his coronet, with the same motto. In this battle the French lost eleven princes, and 30,000 common soldiers, a greater number than the whole army of the conquerors, whose loss was very inconsiderable. When the victory was over, the king tenderly embracing the prince, "My gallant son," he said, "you have nobly acquitted yourself, and well are you worthy of the kingdom." Six weeks after this, Edward's queen defeated the Scots, and took King David prisoner. These memorable battles were fought in 1346. Edward then laid siege to Calais, which he was obliged to reduce by famine, and then returned to England. He then sent over his son, the Black Prince, who, after taking several towns, totally routed the French army, commanded by King John, who had succeeded Philip; and, in this glorious battle, which was fought near Poictiers, took the king, many nobles, and a multitude of private men prisoners, though the French army was six times as numerous as the English.

There were at this time two kings prisoners in England; the French king, who was lodged at the Savoy, which was then a palace; and the king of Scotland, who was confined at Odiham, in Hampshire. They were both treated with great respect. The French king paid for his ransom 500,000l. and a considerable extent of country; and the king of Scots was ransomed for 100,000 marks. The French king afterwards returned to England, and kept his court at the palace of the Savoy, where he died in 1363.

A tedious war was afterwards carried on against the Black Prince by Charles, the French king, in which several battles were fought, to the disadvantage of the English, who lost all they had so bravely conquered in France, except Calais, to which the death of the Black Prince greatly contributed.

At length Edward, after having settled the succession, was taken ill, and died at Richmond, in Surrey, on the 21st of June, 1377, in the 65th year of his age, and the 51st of his reign, and was buried in Westminster abbey. Edward the Black Prince has a monument in the cathedral of Canterbury.

This prince instituted the order of the garter, which is said to have had its rise from the countess of Salisbury's dropping her garter at a ball, which the king taking up, and observing her in a confusion, presented it to her, saying, HONI SOIT QUI MAL Y PENSE—*Evil to him who evil thinks;* when, observing several of the nobles smile, he added, *Many a man has laughed at the garter, who will think it a very great honour to wear such a one.*

RICHARD II.—*From* 1377 *to* 1399.

RICHARD of Bourdeaux, the son of Edward the Black Prince, was but eleven years of age when he was crowned at Westminster, on the 16th of July, 1377. He was put under the tuition of his uncles, John, duke of Lancaster, and Edmund, earl of Cambridge. In this reign, a poll-tax was passed, at 12d. per head, on all above the age of 16. This being levied with severity, caused an insurrection in Kent and Essex; at the head of which were Wat Tyler and Jack Straw. Tyler refusing to pay for his daughter, alleging she was under the age specified in the act, the collector used her with great indecency; on which Tyler beat out his brains with a hammer; then making known the occasion of the murder, he was soon joined by above 100,000 men, who advanced to London, cut off the heads of all the lords, gentlemen, and lawyers, they met with, and plundered and destroyed many houses, &c. The king himself was obliged to come to a conference with Wat Tyler in Smithfield; when William Walworth, mayor of London, gave Tyler such a blow on the head with his sword, that he fell dead at his feet; soon after which they dispersed.

The king knighted Mr. Walworth, and ordained that the mayor of London should ever after bear the title of Lord, and that the dagger should be added to the city arms, which was before a plain cross.

The rebellion also extended into Norfolk and Suffolk, but it was soon suppressed; and the king sent an army into Kent and Sussex, to punish the ringleaders, and Jack Straw, with about 1500 of his followers, were hanged.

The king's fondness for his favourites, Robert de Vere, earl of Oxford, whom he created duke of Ireland, and Michael de la Pool, who was made earl of Suffolk, raised such discontent, that the barons had twice recourse to arms, and at length obliged the king to take refuge in the Tower, and afterwards forced him to resign the crown. Henry, duke of Hereford, the son of John of Gaunt, was then declared king. Richard was removed to Pontefract castle, where Sir Pierce de Exton, with eight ruffians, in hopes of pleasing Henry, rushed in upon him; when Richard, resolving to die like a man, wrested a pole-axe from one of them, and laid four of them dead at his feet; but Exton, mounting on a chair behind him, gave him so violent a blow on the head with a club, that he fell down senseless, and thus died in the 33d year of his age, after a reign of 22 years.

King Henry IV. ordered his body to be removed to Westminster abbey, and caused a monument to be erected to his memory, and to that of his queen, in Edward the Confessor's chapel.

In the fourth year of his reign, a mortality almost depopulated the north of England; in his sixth year, several churches were thrown down by an earthquake; in his twelfth year, there was a great plague and famine; and in this reign guns first came into use. It is also worthy of remark, that peaked, high-toed shoes, fastened to the knees with silver chains, were in fashion about the middle of this king's reign; and soon after side-saddles were used, and long gowns worn, which were introduced by the queen, a Bohemian princess; for, before that time, the English women rode astride like the men.

Henry IV.—*From* 1399 *to* 1413.

Henry IV. surnamed Bolingbroke, was raised to the throne as a reward for his past services, though Edmund

Mortimer was presumptive heir to the crown, as being descended from the daughter of Lionel, duke of Clarence, the third son of King Edward III.; while Henry, duke of Lancaster, was the son of John of Gaunt, the younger brother of Lionel, and the fourth son of Edward III.

Henry, duke of Lancaster, was proclaimed king on the 30th of September, 1399, the very day on which Richard was deposed.

The dukes of Albemarle, Surrey, and Exeter, the earls of Salisbury and Gloucester, the bishop of Carlisle, and Sir Thomas Blount, being Richard's friends, formed a conspiracy in the year 1400, in order to assassinate Henry, and restore Richard to the throne; but being discovered, and their whole scheme frustrated, they assembled an army of 40,000 men, and set up Maudlin, a priest, whose person resembled Richard's, to pretend that he was Richard himself: in this they also failed; most of the leaders were taken and beheaded, and Maudlin was hanged at London; and this conspiracy hastened the death of the late king, who was soon after basely murdered at Pontefract.

Henry used great severity towards the Lollards, or the followers of Wickliffe; and had William Sawtree, a clergyman, burnt in London as a heretic.

In 1402, Henry caused Roger Clarendon, the natural son of Edward the Black Prince, and several others, to be put to death, for maintaining that Richard was alive. The same year he married Johanna of Navarre, widow of the duke of Britanny.

About this time the Scots invaded England, under the earl of Douglas; but were defeated at Hallidon-hill by the earl of Northumberland, and his son, Henry Hotspur, with the loss of about 10,000 men; and in this victory several earls, and many other officers, were made prisoners; but the king ordering Northumberland to deliver up the prisoners into his hands, the earl was so exasperated, that he, with Henry Percy, surnamed Hotspur, his son, and other lords, agreed to crown Edmund Mortimer, earl of March, whom Glendour kept prisoner in Wales. The rebel army encamped near Shrewsbury, headed by Henry Hotspur, the earl of Worcester, and the Scotch earl of Douglas; and the king marched directly thither, with 14,000 choice troops, headed by himself, the prince

of Wales, and the Scotch earl of March; and on the 22d of July, at a place afterwards called Battle field, the king obtained so complete a victory, that about 10,000 of the rebels were killed, among whom was the brave Hotspur, who fell by the hands of the prince of Wales.

In the year 1405 another conspiracy was raised, at the head of which was the archbishop of York, the earl of Northumberland, Thomas Mowbray, earl marshal, and other noblemen, who assembled a large body of troops at York, and published a manifesto, declaring the king a traitor, and that they were resolved to place Mortimer, the lawful heir, on the throne. But this rebellion was soon suppressed by the good policy of Ralph Nevil, earl of Westmorland.

Henry died in the Jerusalem-chamber at Westminster, on the 20th of March, 1413, in the 46th year of his age, and the 14th of his reign, and was interred in the cathedral at Canterbury.

HENRY V.—*From* 1413 *to* 1422.

THIS Prince was the eldest son of Henry IV. and was born at Monmouth in 1388. In his youth he was led in to wild courses; but in the midst of all his extravagancies, he gave a singular proof of his moderation, in suffering himself to be led into prison, by order of the lord chief justice, whom he struck in the execution of his office; and this circumstance gave the people the greatest hope that he would soon change his conduct, nor were they disappointed. He succeeded to the throne at 25 years of age, and was crowned at Westminster on the 9th of April, 1413. The next year commissioners were appointed for adjusting the disputes between the crowns of England and France; but Henry, seeing that nothing could be done by negociation, resolved to have recourse to arms; when Henry Chichely, archbishop of Canterbury, advised him to lay claim to the whole kingdom of France, as the heir and successor of Edward III. This war was approved by the parliament. He therefore demanded the crown of France as his right; upon which, the dauphin, in contempt, sent him a present of a ton of tennis balls, to let him know, that he thought him fitter for play than for war; but Henry sent him word, that he

would soon repay him with such balls as the strongest gates of Paris should not be rackets sufficient to rebound.

Accordingly, in 1415, Henry embarked his army, amounting to 50,000 men, about the beginning of August, on board 1500 transport ships; and landed at Havre-de-Graçe, in Normandy, on the 21st of August, and immediately laid siege to Harfleur, which surrendered in five weeks. Soon after which, the French having assembled an army six times superior to the king's, they challenged him to fight; and Henry accepted it, though the French army consisted of 150,000 men, and the English were reduced to 9000. The French therefore made rejoicings in their camp as if the English were already defeated, and even sent to Henry to know what he would give for his ransom; to which he replied, that a few hours would shew whose care it would be to make that provision. The English, though fatigued with their march, sick of a flux, and almost starved for want of food, were inspired by the example of their brave king, and resolved to conquer or die. In this situation, Henry sent David Gam, a Welch captain, to reconnoitre the enemy, who bravely reported, that *there were enow to be killed, enow to be taken prisoners, and enow to run away.*

The king was encamped, October 25, 1415, on a plain near Agincourt; and having drawn up his small army into two lines (the first commanded by the duke of York, and the second by himself), he disposed his few men to so much advantage, and behaved with such extraordinary conduct and courage, that, by the blessing of Divine Providence, whose assistance he publicly and solemnly implored before the action, by offering up prayers, and exhorting his troops to place all their trust in God, he gained a complete victory, after having been several times knocked down, and in the most imminent danger of losing his life. The English killed upwards of 10,000 men, and took more prisoners than they had men in the army; but an alarm being given, that the French had plundered the English camp, and were returning to the fight, they were ordered to kill all their prisoners; an order which their own self-preservation rendered necessary; but the English soldiers had too much humanity to execute it; upon which a band of ruffians were employed in this massacre.

Henry publicly returned thanks to God, and acknowledged that his success was owing to the favour of Heaven. The loss of the English was no more than 400 men.

In 1417, the king, in order to carry on the war, mortgaged his crown for 100,000 marks, and part of his jewels for 10,000l. He landed at Beville, in Normandy, on the 1st of August, with 25,000 men, reduced Caen, &c.; and the next year all Normandy fell again to the English.

On the 25th of May, 1420, a treaty was concluded at Troy between England and France; wherein it was agreed, that the crown of France should descend to the king of England and his heirs, and that Henry should marry Catherine, the king of France's daughter; which being performed, he returned to England with his queen, who was crowned the year following at Westminster.

Henry, the next year, advanced into France with 30,000 men; but while he was marching towards the river Loire, he was seized with a pleuretic fever, and was carried to Vencennes, where he sent for his brother, the duke of Bedford, &c. and recommended Bedford to take upon him the administration of affairs in France, and that the duke of Gloucester might be protector of England; and expired about two hours after, on the 31st of August, in the 35th year of his age, and the 10th of his reign. His body was carried to Calais, whence it was conveyed to England, and interred in Westminster abbey.

This king was brave, prudent, magnanimous, and merciful; and though he died in the flower of his age, few princes have left behind them such shining proofs of every royal virtue.

This reign was filled with too many glorious actions, to permit historians to record trifling circumstances. It is worthy of remark, however, that on Candlemas day, 1415, seven dolphins were seen playing in the river Thames, and four of them taken.

Henry VI.—*From* 1422 *to* 1461.

Henry of Windsor was only nine months old when his father died. This young prince was proclaimed King of England, and heir of France; and his uncles, John, duke of Bedford, and Humphrey, duke of Gloucester, were resolved to maintain what his father had procured for him. But as Charles VI. died at Paris on the 20th

of October, 1421, the face of affairs was soon changed in France. Henry was proclaimed King at Paris, and the Dauphin at Poictiers; and several battles were fought, in which the English had generally the advantage. The earl of Salisbury had invested Orleans, and when it was near being surrendered, a country girl, named Joan of Arc, who had been bred to the keeping of sheep, undertook to deliver France from the English. She bore the arms and habit of a man, headed the French, and, by her frequent and successful sallies, obliged the English to raise the siege; then pursued and harassed them, retook several places, attacked and defeated the brave Lord Talbot, and took him prisoner. At length, after a number of astonishing exploits, this great heroine was taken at Compeigne, and burnt for a witch by the duke of Bedford's order.

At twelve years of age, King Henry was carried to France, and crowned at Paris; but still the war continued. The duke of Burgundy, who had been in the English interest, joined with Charles, and Paris shook off its allegiance to Henry. The duke of Bedford died about this time; so that a truce was concluded, when King Henry's marriage with Margaret of Anjou, the daughter of the titular king of Sicily, contributed to complete his misfortunes.

The queen determined to ruin the duke of Gloucester, who was presumptive heir to the crown. He was seized, and, being closely confined, was the next day found dead in his bed, smothered by the queen's order. Gloucester's death occasioned the duke of York to lay claim to the crown.

This prince was descended from Lionel, duke of Clarence, third son to King Edward III., and King Henry was descended from John of Gaunt, duke of Lancaster, the fourth son of the same monarch; so that the right of primogeniture was plainly on the duke's side.

This reign was full of domestic broils. The duke of York's interest gained ground, and his arms were at first successful against the king, over whom he gained a complete victory at St. Alban's, took the king prisoner, and conducted him to London; and calling a parliament in Henry's name, was declared protector of the kingdom.

The queen raised an army in the north, and the duke of York advanced to meet her; but his army being in-

considerable, he was defeated and slain at Wakefield; and his youngest son, the earl of Rutland, not above twelve years old, was cruelly killed by Lord Clifford; and the earl of Salisbury was beheaded.

Richard Plantagenet, duke of York, being thus dead, Edward, earl of March, his eldest son, took his title, and asserted his claim to the crown with an army of 23,000 men, and, being victorious in several engagements, marched directly to London, obliged the queen to return into the north, and was unanimously acknowledged king.

Thus ended the reign of Henry VI. which had lasted 38 years and a half.

EDWARD V.—*From* 1461 *to* 1483.

EDWARD came to the throne in the year 1461, and the 20th of his age. No sooner was he proclaimed king, than he pursued the queen into the north; and both armies meeting, a bloody battle was fought, in which 30,000 men were slain, and the king and queen defeated; on which King Henry and Margaret fled with the young prince to Edinburgh; but Henry, returning into England soon after in disguise, was seized, and conducted on a wretched horse, with his legs tied to the stirrups, to the Tower.

The earl of Warwick had been the chief instrument in raising Edward to the throne; but that prince employing him to negociate a marriage for him in France, and in the mean time marrying Elizabeth, the widow of Sir John Grey, the earl was so exasperated, that he raised a rebellion, in which he twice defeated the king's forces, and afterwards took his majesty prisoner, and confined him in Middleham castle, from whence he escaped, and, joining the Lord Hastings in Lancashire, returned to London, when another battle ensued, and Warwick's army being defeated, he was obliged to fly into France. The earl of Warwick landed soon after at Dartmouth with a few troops, which he soon increased to 60,000 men, upon which Edward also raised a numerous army at Nottingham; but as his enemies were advancing, the cry of King Henry was raised in his camp, on which Edward fled into Flanders. Warwick then took Henry out of the Tower, and he was again acknowledged the lawful king of England. But Edward afterwards returning to London, he

was received with acclamations of joy, and Henry again was committed to the Tower.

Another battle was fought at Barnet, between King Edward and the earl of Warwick, in which the great earl of Warwick was slain, and 17,000 men. Some days after, the remainder of the earl's army was assembled by the Lancastrians, and, being joined by other forces, was headed by the queen; when Edward defeated her at Tewkesbury, and took her prisoner, with her son, Prince Edward, the duke of Somerset, &c. The prince, being carried to Edward's camp, was asked why he was so rash as to enter the kingdom in arms; to which he boldly replying, that he came to recover his right, unjustly usurped, Edward struck him with his gauntlet on the mouth; when the dukes of Gloucester and Clarence, the earl of Dorset, and the Lord Hastings, stabbed him with their daggers, and thus massacred an amiable prince in the 18th year of his age: and soon after King Henry was murdered in the Tower by the duke of Gloucester, or, as others say, died with grief, in the 42d year of his age.

Queen Margaret, after being four years confined in the Tower, was ransomed by her father for 50,000 crowns. Edward caused his brother, the duke of Clarence, to be drowned in a butt of sack. At length, King Edward was seized with a fever, or, according to others, with an apoplexy, and died at Westminster on the 9th of April, 1483, in the 42d year of his age, and the 23d of his reign. King Edward had a curious monument in the new chapel in Windsor, founded by himself. Jane Shore, whom Edward had from her husband, was his favourite mistress, for which she was persecuted in the reign of Richard III. and did public penance in St. Paul's church.

EDWARD V.—*Two Months and twelve Days of* 1483.

THE young prince was at Ludlow when his father died, but, being sent for to London, was trepanned by his uncle, the duke of Gloucester, and lodged in the bishop of London's palace, where, on the 4th of May, 1483, he received the oaths of the principal nobility, and Gloucester was made protector of the king and kingdom: he obliged the queen to deliver up to him the duke of York also, and then sent them both to the Tower, under a pretence of preparing for the coronation; the Tower at that time be-

ing a royal palace, from which the processions at coronations was usually made to Westminster. Meanwhile the duke of Gloucester, by the assistance of Stafford, duke of Buckingham, Sir John Shaw, lord mayor of London, and Dr. Shaw, his brother, had his two nephews, and even the late king, declared illegitimate, and himself acknowledged king of England, pretending at the same time to accept the crown with reluctance; though, to produce this revolution, he had put to death the Lord Hastings, who was strongly attached to the young king.

As Lord Hastings was greatly beloved by the people, Gloucester pretended, that the ambition of Hastings had endangered the safety of the kingdom; though, in fact, he was arrested only on a trumped-up charge of sorcery. The queen and Jane Shore were accused as his colleagues, and Jane Shore was taken into custody, but was soon after released, on doing penance.

Richard's first care was to dispatch the young prince; and Sir Robert Brackenbury, lieutenant of the Tower, refusing to comply with his cruel designs, he, for one night only, gave the command of the Tower to Sir James Tyrrell, and he procured two villains, who, in the dead time of night, entered the chamber where the princes lay, and smothered them in bed; after which, they were buried under the stair-case, where their bones were discovered 191 years afterwards, and, by order of King Charles II., deposited in Westminster abbey, and a small monument erected to their memory in Henry the Seventh's chapel.

The tyrant Richard, his tool Buckingham, and the other murderers, were soon after overtaken by the arm of the Almighty.

RICHARD III.—*From* 1483 *to* 1485.

RICHARD, the brother of King Edward IV. and the uncle and murderer of King Edward V., was proclaimed king on the 20th of June, 1483, but was not crowned till the 6th of July. He was now in the 32d year of his age, and, as he had waded to the throne through injustice and violence, he endeavoured to gain the favour of the nation by popular laws. However, though he had promised the duchy of Hereford to the duke of Buckingham, his chief

instrument, he refused to perform that promise. At this Buckingham being exasperated, left the court, and entered into a confederacy with Henry Earl of Richmond, the next heir to the crown of the Lancaster race, who was still in Brittany, where his mother informed him of what had happened in England, and desired he would speedily land in Wales. Meanwhile, the king suspected a conspiracy, and sent for Buckingham to court, who refused to obey the summons, immediately collected his forces in Wales, and began to march towards the western counties; but the Severn rising with a great inundation, he was unable to pass that river, and his army dispersed, and left him only with a single servant. In this melancholy situation he retired into Shropshire, and sheltered himself in the house of Ralph Bannister, who had been his servant, and received many favours from him, but the king offering 1000l. reward for the taking of him, Bannister villainously betrayed his master, who was beheaded at Shrewsbury without any legal process.

The Earl of Richmond at length sailed for England with 40 ships and 500 men, but his fleet being dispersed in a storm, he was obliged to return. Upon this Richard cruelly sacrificed all whom he suspected to favour the earl, concluded an alliance with the Scots, and even corrupted the Duke of Brittany's treasures to destroy Richmond, but he saved himself by escaping into France.

As Henry had solemnly engaged to marry Elizabeth, the eldest daughter of Edward IV. Richard poisoned his own wife, and then endeavoured without effect to prevail on the young princess his niece to accept him for her husband. Meanwhile Henry landed at Milford-Haven, with only 2000 men, immediately began his march towards Shrewbury, and was joined by many of the nobility with all the forces they could raise. At length both armies met at Bosworth, the king having 13,000 men, and the Earl only 5000. The engagement was hot and doubtful, till the Lord Stanley, and his brother joined the earl with fresh troops, when Richmond soon obtained the victory, in which King Richard lost his life; and the crown being found in the field of battle was placed on Henry's head. Richard's body was after the battle, found entirely naked, covered with blood and dirt, and being thrown a-cross a horse was conveyed to Leicester, and interred without the least ceremony.

Thus fell Richard on the 22d of August, 1485, in the 34th year of his age, and the 3d of his reign. He was, from his deformity, surnamed Crook-backed, and one of his arms was almost withered. He had a solid judgment, and was naturally brave.

Richard left only a natural son, who, perceiving his father's fate, went to London, and put himself apprentice to a bricklayer, which business he occupied to his death.

HENRY VII.—*From* 1485 *to* 1502.

HENRY, having defeated King Richard, was crowned at Westminster, on the 30th of October, 1485, and the next year married the Lady Elizabeth, the eldest daughter of King Edward IV. by which means the two houses of York and Lancaster became united. However, the house of York procured one Lambert Simnel, a young student at Oxford, to pretend that he was the son of the Duke of Clarence, brother to King Edward IV. but after being crowned king in several places he was defeated and taken prisoner: yet the king spared his life, made him turnspit in his kitchen, and afterwards his falconer.

Soon after, Margaret, Duchess of Burgundy, a princess of the house of York, introduced another pretender, named Perkin Warbeck: he personated Richard, Duke of York, Edward the fifth's brother, who was smothered with that prince in the Tower. This adventurer attempted to land in Kent, with a few followers; but several of his adherents being executed, he fled to Ireland, and from thence to Scotland, where he married the Earl of Huntly's daughter, and was twice sent with an army into England, by the King of Scotland; but, being both times defeated, was obliged to retire into Cornwall, where he raised an army, with which he laid siege to Exeter; but the King's forces advancing, he fled again; when his wife being taken, a pension was assigned her, on account of her family and beauty. Perkin, some time after, surrendered himself, and was committed to the Tower, where he made his escape; but was again taken, and endeavouring to corrupt his keepers, was at length hanged. Henry also, for his own security, caused the Earl of Warwick, the Duke of Clarence's son, whom Simnel had personated, and who had

been confined in the Tower from his infancy, to be beheaded.

King Henry married his eldest son Arthur, to Catharine, the daughter of Ferdinand, King of Spain, and his daughter Margaret, to James, King of Scotland; when England, being blessed with tranquillity, he was continually making use of new means to heap up riches for which he had no use: for this purpose, he employed Sir Richard Empson and Edmund Dudley, two lawyers, who caused many wealthy persons to be indicted for several crimes, and then obliged them to compound with the king; by which, and other illegal and shameful oppressions, the king amassed 1,800,000l. sterling, which was more than double the value in our present money.

At length, Henry grew so absolute that no man durst oppose him. But a little before his death, he ordered by his will, that his heirs should restore what his officers and ministers had unjustly taken from his subjects. He died at Richmond, in Surry, on the 22d of April, 1509, in the 53d year of his age, and the 24th of his reign, and was interred in his own new chapel at Westminster. Both the chapel and his monument are exquisite pieces of workmanship.

Henry exceeded the common stature, was straight-limbed, but slender, and had a handsome person. In the year 1487, he instituted the Star-chamber, under the pretence that the channels of justice were corrupted. He promoted commerce, and sent Sebastian Cabot to make new discoveries in America. In his 15th year was a great plague, of which 30,000 died in London.

HENRY VIII.—*From* 1509 *to* 1547.

HENRY VIII. was born at Greenwich, on the 28th of June, 1491, and succeeded his father, Henry VII. on the 22d of April, 1509, in the 18th year of his age. He redressed the grievances of the former reign, put Empson and Dudley to death, and wrote a book against Luther; on which the Pope conferred on him and his successors, the title of Defender of the Faith. Soon after his accession, he passed over into France, and took Terouane, Tournay, and some other places. In the mean time, King James, of Scotland, invaded England, but was defeated at the fa

mous battle of Flodden-field, when King James, many nobles, and 9000 common soldiers were slain.

In this reign, Thomas Wolsey, the son of a butcher at Ipswich, from being a common priest, was at length raised to the See of York, the dignity of a Cardinal, and the post of Lord High Chancellor of England. His pride encreased with his riches, and he caused the Duke of Buckingham to be beheaded for saying, *That if the King died without heirs, he thought he had a right to the throne;* but the real cause was his affronting the cardinal, by pouring water into his shoes, when he had the impudence to dip his hands in the bason while the duke held it to the king to wash. Cardinal Wolsey afterwards lost the favour of the king, and was arrested for high treason; this threw him into a fit of illness, of which he died. King Henry having conceived a passion for Anna Bullen, caused his queen, Catherine, to be divorced, under pretence of her having been first married to his brother Arthur; and married Anna Bullen, Nov. 14, 1532, and she was crowned the first of July following. By the former, he had Mary, and by the latter, Elizabeth. The Pope now threatening to excommunicate Henry, both he and the parliament were so exasperated, that in 1534, they passed an act, abolishing the papal authority in England. The parliament now acknowledged the king supreme head of the church; for refusing to acknowledge which, Bishop Fisher, Sir Thomas Moore, and others, lost their heads.

Henry was then excommunicated, and his subjects absolved from their allegiance; upon which the king suppressed their monasteries, and seized their revenues, &c.

Queen Anna Bullen lived with the king only till she had borne the Princess Elizabeth. Soon after which, she was cruelly beheaded, with some of her relations and domestics, on a charge of incontinency; of which there is the greatest reason to believe her innocent. Henry then married Jane Seymour, who died in child-bed of Prince Edward; when it being impossible to save both, he was asked which should be spared, the mother or the child; he replied, *That he could easily procure another wife, but was not sure that he should have another son.* He next married Anna, of Cleves, whom he soon divorced, and then beheaded; as he did Thomas Lord Cromwell for promoting that match. His fifth wife, Catharine Howard, was, like Anna Bullen, beheaded for adultery; and Deerham,

Mannock, and Culpepper, confessing that they had often lain with her, were all three beheaded. But Catharine Parr, his last wife, survived him.

Henry died in the night between the 28th and 29th of January, 1547, in the 57th year of his age, and 38th of his reign, and was interred at Windsor.

EDWARD VI.—*From* 1547 *to* 1553.

EDWARD, the only son of King Henry VIII. and Jane Seymour, ascended the throne at nine years of age, being well skilled in the Latin and French tongues, and had acquired some knowledge of the Greek, Italian, and Spanish, and was committed to the care of sixteen persons, whom Henry had nominated regents, and governors of his son; the chief of whom was the Earl of Hertford, the King's uncle, by the mother's side, who was soon after made duke of Somerset, and protector to the young king.

Henry left the reformation very imperfect; but the protector, assisted by Archbishop Cranmer, &c. made use of this opportunity to improve it.

The young Queen of Scotland was now demanded in marriage for King Edward: but the same proposal being made by France in behalf of the Dauphin, she was sent into that kingdom; on which the Duke of Somerset invaded Scotland, met their army at Musselburgh, and though the duke's army amounted to only 18,000 men, and the Scots to 30,000, the Scots were defeated with the loss of 14,000 killed, and 1500 prisoners; and what is surprising, the English are said to have lost only 31 horsemen, and 1 foot soldier.

Private masses were now laid aside; prayers were read in English, &c. However, Joan Bocker, embracing the opinions of the German baptists, was burnt as a heretic; but the young king set his hand to the warrant with tears in his eyes, telling Archbishop Cranmer, "That if he did wrong, since it was in submission to his authority, he should answer to God for it."

These alterations occasioned great disturbance in the kingdom, which were at length suppressed, some by force, and others by a proclamation for a general pardon.

The duke of Somerset's power raised him many enemies, the chief of whom was his brother Thomas Lord Sey-

mour; but articles of accusation being exhibited against him, he was attainted in Parliament, and without an open trial condemned and beheaded. The duke of Somerset was some time after charged with a design to seize the king, and to imprison the earl of Warwick, which was both felony and treason. He was acquitted of treason, but condemned for felony; and the young king being prevailed upon to sign the sentence, he was executed some time after. The earl of Warwick, now duke of Northumberland, succeeded to the duke of Somerset's power, and at length (on the King's being taken ill of the measles) married the Lord Guildford Dudley, his fourth son, to the Lady Jane Grey, eldest daughter to the duke of Suffolk, and persuaded Edward to settle the crown on her, his sisters, Mary and Elizabeth, having been both declared illegitimate during the life-time of their father; and the prince, hoping to save the reformation from impending destruction, appointed her his successor, and soon after died, July 6, 1553, in the 16th year of his age, and the 7th of his reign. He was interred in Westminster Abbey, but his monument was afterwards destroyed in the civil wars.

MARY I.—*From* 1553 *to* 1558.

THE duke of Northumberland kept the death of the young king for some time concealed; and when the Lady Jane, who was distinguished by her beauty, virtue, and learning, was informed of the settlement which her cousin Edward had made of the crown, she was with difficulty prevailed on to receive it, but was proclaimed in London with the usual formalities. In the mean time, the counties of Norfolk and Suffolk declared for Mary, and furnished her with troops, on her promising to leave religion in the same state she found it. The duke of Northumberland marched from London to oppose them; but being deserted by his troops, he endeavoured to save himself by declaring for Mary; and in Cambridge market place he proclaimed her queen. The Duke of Suffolk was ordered by the council to deliver up the Tower, and the Lady Jane Grey to quit the title of queen.

Mary was determined to sacrifice those whom she considered as her principal enemies. The duke of Northum-

berland, with several other persons of distinction, were tried and executed.

She was crowned on the 1st of October, 1553. She soon after married Philip II. King of Spain, and openly declared for popery. An insurrection in Kent was raised by Sir Thomas Wyatt, who was beheaded; and the duke of Suffolk, endeavouring to raise forces in Warwickshire, not only that duke, but his daughter, the Lady Jane Grey, and the Lord Guildford Dudley, his son-in-law, were beheaded.

Persecution for religion was now carried to a terrible height: Cranmer, Ridley, Latimer, and Ferrar, with some hundreds of persons, of different ranks and sexes, were burnt alive. The Princess Elizabeth was closely watched, and obliged to dissemble her religious sentiments; and her answer to Gardiner, who put the dangerous question concerning these words of Christ, "This is my body," was full of caution, and a proof of her wit and good sense.

Christ was the word that spake it;
He took the bread and brake it;
And what the world did make it,
That I believe and take it.

The people of England were greatly disgusted at the behaviour of Philip, who, soon after his arrival, declared war against France, and obtained a supply of 8,000 English, by whose assistance the French were defeated at the battle of St. Quintin; but they soon after took Calais, which was the only strong place the English had left in France. Philip had before been greatly disgusted with the queen, for falsely imagining herself with child; and this, added to the loss of Calais, threw her into an ill state of health; and while the people saw nothing but cruelty in the council, poverty in the exchequer, pride in the court, dissension at home, and contempt abroad, she died on the 17th of November, 1558, in the 43d year of her age, and was interred in King Henry VII's chapel, at Westminster.

ELIZABETH.—*From* 1558 *to* 1603.

ELIZABETH was proclaimed queen the day her sister died. The House of Commons addressing the Queen to

marry, she excused herself by saying, *that by the ceremony of her inauguration she was married to her people.*

The Dauphin having married Mary, Queen of Scotland, they assumed the title of King and Queen of Scotland, England, and Ireland. But Mary becoming a widow, by the death of Francis II. King of France and Scotland, she quitted the title of Queen of England, and returned to her own kingdom. She then married her cousin, Henry Stuart, Lord Darnley; but being accused of many familiarities with Rizzio, her husband became jealous, on which the Earl of Moreton and some others murdered Rizzio. Queen Mary now bestowed all her favours on the Earl of Bothwell, who murdered the King soon after her delivery of a prince, who was afterwards James I. King of England, and a few months after the murder, that earl married the queen. But Mary being in danger of her life, fled to England, where she was imprisoned by Queen Elizabeth. The new born prince was immediately set on the throne of Scotland; and Mary, after eighteen years confinement, was beheaded for a conspiracy carried on in her favour.

Queen Elizabeth assisted to the utmost of her power, the protestants both of France and Holland. Philip II. King of Spain, exasperated at the assistance Elizabeth had given the Dutch, though he had before sought her in marriage, now formed the design of dethroning her, and prepared a prodigious fleet, which was called the Invincible Armada; but that fleet having entered the Channel, was bravely attacked by Elizabeth's admirals, on the 21st of July, 1588; when, after a bloody engagement, the English Admirals convinced the seamen, that the dreadful apprehensions they had entertained of the large Spanish ships were groundless. The action was renewed on the 23d, when a sharp engagement ensued off Portland. A running fight was continued the next day; and on the 25th another terrible rencounter happened off the Isle of Wight. The Spaniards then bore down to the coast of Flanders, and were still pursued by the English; who, in the night of the 28th, sent eight fire-ships among the Spanish fleet, which had anchored off Calais. The Spaniards then cut their cables and put to sea, were pursued by the English, who took some of their ships, and drove the rest on the coast of Zealand: but the wind chopping about, they escaped and returned home by sailing round Scotland

and Ireland; in which attempt several of their ships were taken by the English, and many of them were wrecked by tempests on the coast of Ireland; very few of that Armada were able to get back into the ports of Spain. Lord Howard, of Effingham, Sir Francis Drake, Captain Hawkins, and Captain Forbisher, were the chief commanders. The Spaniards lost 32 capital ships, with 13,500 men.

The next year, she sent a fleet of 100 sail, under the command of Sir Francis Drake and Sir John Norris, who plundered the Groyn, seized 60 ships in the Tagus, and destroyed Vigo.

The Spaniards, in 1596, were preparing to invade England again; upon which the Queen fitted out a fleet of 150 sail, with 22 Dutch ships, under Howard, Essex, Raleigh, and Vere: when the Spanish fleet, which lay at Cadiz, was defeated by Raleigh, who took 4 ships, and the rest, which consisted of 13 men of war, 11 ships freighted for the Indies, and 33 others were burnt by the Spanish admiral himself, after his having offered in vain to ransom them for two millions of ducats. The stores prepared against England were seized, the city plundered and burnt to the ground, and the loss of the Spaniards was estimated at 20 millions of ducats. The English returned with a prodigious booty.

The Earl of Essex, who was the Queen's favourite, was sent as deputy-lieutenant to Ireland, with 20,000 men, to quell a rebellion, raised by the Earl of Tyrone. Essex, finding he had enemies near the queen, solicited in vain to return to England: he then grew inactive, and the rebels gained ground. At length, concluding a truce with Tyrone, he returned to England; but was soon after suspended from all his employments, afterwards attempting a change in the ministry, he was beheaded. Tyrone was at length defeated, by Lord Mountjoy, and implored the Queen's mercy.

Elizabeth died on the 24th of March, 1603, in the 70th year of ner age. She was interred in Henry VII's chapel.

She understood the Greek, Latin, French, Spanish, and Dutch languages; spoke all but the last with great fluency, and encouraged them at her court.

JAMES I.—*From* 1603 *to* 1625.

ON the death of Queen Elizabeth, James VI. of Scotland, was next heir to the crown, he being descended from the eldest daughter of King Henry VII. and in him the crowns of England and Scotland were united. King James and his Queen were crowned at Westminster, on the 25th of July, 1603.

In 1605, the plot to destroy the King and parliament, was discovered by an anonymous letter, directed to Lord Monteagle. In a cellar, under the parliament house, there were found 36 berrels of gunpowder, upon which were laid bars of iron, massy stones, &c. near to which was Guy Fawkes, concealed with a dark lanthorn and three matches, who instantly confessed himself guilty; and with Sir Everard Digby, Catesby, and several others, were executed. Frederick, elector Palatine, married the King's daughter Elizabeth, from which marriage the present royal family descended; the princess Sophia, King George the I's mother, being the immediate issue of it. A little before this marriage, Prince Henry, the King's eldest son, and Prince of Wales, died in the 18th year of his age. It was generally believed he was poisoned by Rochester, the royal favourite.

The great Sir Walter Raleigh, the glory of his country, had been thrown into prison for being one of the principals in a ridiculous plot, pretended to have been formed in favour of King James's cousin german, the Lady Arabella Stuart, before James's coronation, of which he was unjustly found guilty, without legal proof, and had been fourteen years confined in the Tower, when he was discharged, and sent on an expedition in quest of a gold mine, on the coast of Guiana; but returning without effecting the discovery, to please the Count of Gondomer, the Spanish ambassador, he was re committed to the Tower, and cruelly beheaded on his former sentence.

The Dutch, who owed their freedom to England, now despised James's power, and massacred the English at Amboyna: where they put the factory to death, and seized their effects.

King James's son, Charles, prince of Wales, was married to the daughter of the French King, Henry IV. and as she was a papist, she established that religion in the family of

the Stuarts. King James died on the 27th of March, 1625, in the 59th year of his age, and was buried in Westminster Abbey.

His ignorance of the English constitution, induced him to strain the royal prerogative. He had, however, some virtue blended with his many vices, and he promoted the commerce of the kingdom.

In 1606, Virginia was planted with an English colony; soon after which New England, and the Bermuda Islands, were made English plantations.

CHARLES I.—*From* 1625 *to* 1649.

KING Charles was born at Dumfermline, in Scotland, on the 19th of November, 1600, and succeeded his father James I. in the 25th year of his age, but was not crowned till the 2d of February, 1626.

King Charles, soon after his marriage, entered into a war with Spain, and sent a fleet against Cadiz, which proved unsuccessful. However, resolving to carry on the war, and the exchequer being exhausted, he called a parliament, when supplies not being granted, he had recourse to raising money without a parliament.

He then declared war against France, in which meeting with no success, a peace was concluded between England, France, and Spain. After this, the King called another parliament, and endeavoured to have the duty of tonnage and poundage, (granted only for certain purposes,) put entirely into his hands; but the parliament not complying, he dissolved them. The revenues of the crown being now insufficient for its support, the ministers proceeded to the following rigorous methods of raising money, viz. They exacted the duty of tonnage and poundage; granted very numerous monopolies; a general loan was proposed, and the people had soldiers billeted on them to compel payment; several gentlemen were imprisoned for not subscribing; and a tax was imposed under pretence of protecting the coast from pirates. The dissenters were severely persecuted, and the King obtained considerable sums by heavy fines imposed in the Star Chamber.

After a long disuse of parliaments, Charles was obliged to recal one, in 1640; they renewed the complaint of grievances; extorted a favourable declaration from the

King, and even obliged him to make the parliament perpetual, unless they consented to their dissolution.

Wentworth, earl of Strafford, and Laud, archbishop of Canterbury, being the King's principal advisers, were both tried and beheaded.

A rebellion broke out in Ireland, in which 150,000 protestants were cruelly put to death by the papists, pretending that they acted by the King's authority, though he solemnly disclaimed it. In short, tumults between the King and parliament now began to run high; but the first act of hostility was the King's appearing before Hull, and summoning Sir John Hotham, the governor, to surrender, which he absolutely refused.

King Charles then set up his standard at Nottingham; and the parliament raised forces, and made the earl of Essex their general; and soon after a battle was fought near Edge Hill, in which each party claimed the victory, and about 5000 men were killed on both sides.

The next year the King's army was successful in the west of England; but his forces in the north were entirely routed at Marston Moor, and the King engaging with Essex again at Newbury, was obliged to retreat with great loss.

In 1645, Sir Thomas Fairfax was made general in chief over the parliament's forces, in the room of the Earl of Essex, and Oliver Cromwell was appointed lieutenant-general: when the two armies coming to an engagement, the parliamentarians obtained a complete victory.

The next year the King made his escape to the Scotch army; but the Scotch at last consented to deliver the King to the parliament, in consideration of the sum of 400,000l. which was done at Newcastle, on the 30th of January, 1647, when he was escorted by Sir Thomas Fairfax, with 900 horse to Holmby House, in Northamptonshire.

Cromwell, who had distinguished himself by his military bravery, now ingratiated himself with the soldiery, and became formidable to the parliament itself. He introduced the officers, and some of the most sensible of the common soldiers into the House of Commons, under the name of Agitators; and Cromwell acted as their King. They sent to Holmby, and took the King into their hands; and at length brought him to St. James's, when an order was passed for bringing him to trial: accordingly, a new court was erected, called the high court of justice. The

president was John Bradshaw, serjeant at law. The king being several times brought before the court, and disowning its authority, sentence was pronounced against him on the 27th of January, 1649; and on the 30th of the same month he was beheaded on a public scaffold, at Whitehall, in the 49th year of his age. On the scaffold he declared himself a protestant, and denied his having any ill designs on his people.

THE COMMONWEALTH OF ENGLAND.—*From* 1649 *to* 1658.

THE parliament had no sooner destroyed the king, than they declared the royal power dangerous, and voted the house of lords useless. They next appointed forty members of the executive power, under the title of 'The Council of State.'

Cromwell was then sent into Ireland to reduce the rebels, and in about nine months made great progress towards the reduction of that island; but the Scots revolting, and calling over the young king, the parliament sent for Cromwell in haste, and a battle was fought on the 3d of September, 1650, at Worcester, in which Cromwell defeated the king's army. His majesty on this fled to the house of William Penderel, at Boscobel, on the confines of Staffordshire, where he lodged at night in a garret, and in the day sat in a large oak in an adjacent wood: he at length escaped to Normandy.

Cromwell afterwards defeated the Scots at Dunbar, took Edinburgh castle, and entirely reduced that kingdom.

Cromwell, in 1653, set up a council of state, who some time after gave him the title of "The Lord Protector of England."

The commonwealth was long at war with the Dutch, and in several battles at sea the English distinguished themselves by an amazing intrepidity; in one of which the English, with 100 ships, beat the Dutch, who had 120.

Cromwell made peace with the Dutch, obtained Dunkirk, took Jamaica, and, in short, made his name universally formidable.

At length Cromwell died on the 3d of September, 1658, about which time there was one of the most violent tempests ever known in England.

Soon after the protector's death, the people turned their thoughts to the restoration of the royal authority and family, which was brought about by General Monk; and King Charles II. was invited to England, and proclaimed king, May 8, 1660. On the 28th he landed at Dover, and on the 29th made his public entry through London on horseback, attended by his two brothers, James, duke of York, and Henry, duke of Gloucester.

CHARLES II.—*Nominally from* 1649, *actually from* 1660 *to* 1685.

CHARLES II. was crowned on the 23d of April, 1661. One of the first laws passed in his reign was an act of indemnity, excepting those personally concerned in the death of his father, and a few others.

King Charles was married to Catharina, infanta of Portugal; and, in 1664, entered into a war with the Dutch, in which several naval battles were fought, and, in particular, a very bloody one on the 3d of June, 1665; when Opdam, the Dutch admiral, lost his life, together with his ship, and 19 others taken, burnt, or sunk: but in 1667, the Dutch sailed up the Medway, and burnt many of our ships at Chatham; soon after which a peace was concluded.

In 1678, one Titus Oates went into Spain, and having informed himself of a plot formed by the pope, the king of France, the duke of York, and others, applied to Sir Edmundbury Godfrey, a justice of peace in Westminster, and represented to him, that they had formed a design to murder the king, and subvert the protestant religion in England. On this, Sir Edmundbury Godfrey took his deposition; but was soon after murdered, and his body found in a ditch. Several persons were tried and hanged for that murder.

The Presbyterians were then charged with a plot by the Papists; and, for this pretended conspiracy, the brave Lord Russel, Colonel Sidney, and the earl of Essex, lost their lives.

In 1667, Lord Chancellor Hyde, whose daughter had been married to the duke of York, was disgraced, and went to France, where he wrote the History of the Rebellion. Though the duke of York was a Papist, yet that

was made so great a secret, that the people were fined for mentioning it. The King suffered Louis XIV. to be supplied with timber for building ships; and selling Dunkirk, which Cromwell had procured for England, employed the purchase-money in his pleasures.

King Charles died on the 6th of February, 1685, in the 55th year of his age, and was buried in Westminster Abbey.

In this reign Milton wrote his Paradise Lost, and Butler his Hudibras; Waller, Cowley, Dryden, and Roscommon also did honour to the nation by their writings.

In 1665, a plague carried off in London 70 or 80,000 persons. In 1666, was the dreadful fire, which burnt above 13,000 houses, and 90 churches. In this reign, a person named Blood, stole the crown, sceptre, and regalia, out of the Tower, but was discovered and taken. In 1683, there was so severe a frost from the middle of November to the 5th of February, that Hackney coaches plied on the Thames.

JAMES II.—*From* 1685 *to* 1688.

JAMES, Duke of York, was proclaimed King on the 6th of February, 1685. In the privy council he promised to preserve the government of church and state; yet he went publicly to mass two days after his accession.

The coronation of the King and Queen was on the 3d of April. Titus Oates, the discoverer of the Popish plot in the late reign, was now punished with severity. Mr. Dangerfield, and Mr. Richard Baxter, also received severe treatment: the former for discovering a pretended plot, and the latter for reflecting on the prelates.

The Duke of Monmouth landed at Lyme, in Dorsetshire, with only 83 followers, on the 11th of June, and published a declaration: That his sole motive for taking arms was to maintain the protestant religion, and to deliver the nation from the usurpation and tyranny of James, Duke of York, and that his mother was actually married to King Charles II. but he was taken prisoner, and beheaded on Tower Hill, July 15, 1685.

Those who had espoused his cause, were now butchered by military execution, under General Kirk, or Judge Jefferies.

In short, about 600 persons were hanged, and the steeples, tower gates, and roads were stuck with their heads and limbs.

Several arbitrary and scandalous proceedings were carried on against the protestants at the instance of the King.

Meanwhile, the Queen was said to be delivered of a prince, on the 10th of June, 1688, though such measures were taken, as raised a suspicion of its being a design to impose an heir upon the kingdom. This event alienated the minds of the princesses Mary and Anne, the King's own undisputed children, by Lady Anne Hyde.

The Prince of Orange, stadtholder of the United Provinces, had married Mary, King James's eldest daughter, and was himself the son of that King's eldest sister; he naturally attracted the regard of the people of England, who applied to him for deliverance. He landed at Torbay, on the 4th of November, 1688, and was joyfully received by the people.

The King's commissioners treated with the Prince of Orange. The prince made very moderate proposals, but James chose to desert his kingdom rather than retract what he had done in favour of the Popish religion; and being disguised, embarked in a vessel, near Feversham, in Kent, where he was stopped by some fishermen and brought back to London; but he fled a second time, and escaped into France, December, 1688. He spent the last twelve years of his life at St. Germain's, where Louis XIV. allowed him a pension of 50,000l. sterling per annum, and his daughter Mary 4,000l. which he received secretly. At length, he died there in 1701, in the 68th year of his age.

WILLIAM III.—*From* 1688 *to* 1702.

UPON King James's departure, the lords and commons at length agreed that he had abdicated the throne. Then the Princess Mary and the Prince of Orange were proclaimed King and Queen, on the 13th of February, 1689, and crowned on the 11th of April following.

An attempt was made to secure Scotland for King James; but on the 26th of May, 1689, the two armies met at Killicranky, in the shire of Perth, when Lieutenant-General Mackey, who commanded for King William, obtained a victory: after which the whole island of Great Britain submitted to King William.

In Ireland, Tyrconnel had disarmed the protestants in a great part of the kingdom, and formed an army of Papists, amounting to 30,000 foot and 8,000 horse, while the Protestants in the north took up arms for King William. Meanwhile, James made his public entry into Dublin, and headed 20,000 men, and was twice reinforced by the French with 5,000 men each time. James's forces were often defeated; and at length William arriving in person, he gained a complete victory over James at the battle of the Boyne, and thereby established himself on the throne of Ireland. James then took shipping for France.

Soon after the battle of the Boyne, King William returned to England; but another battle was fought June 30, 1691, at Aughrim, between the English, commanded by General Ginkle, and the Irish, assisted by the French; when the English gained a complete victory; and thus an end was put to the war in Ireland.

About this time, King William formed a grand alliance against Louis XIV. and headed the allied armies in several battles; at length the French made overtures of peace, and the treaty was concluded at Ryswick, in 1697.

Whilst the King was thus engaged abroad, his illustrious Queen died, December 28, 1694, and was greatly lamented.

Several conspiracies were formed in favour of James, during King William's reign, the most remarkable of which was the assassination plot for murdering the prince in his coach; for which Sir John Fenwick and others were executed.

King William was thrown from his horse, by which his collar-bone was dislocated, and he died on the 8th of March, 1702, aged 51 years, and was interred in Henry VII's chapel.

ANNE.—*From* 1702 *to* 1714.

THE crown devolved to the Princess Anne, daughter of James II. This princess was born at St. James's, February 16, 1665; was married to George, Prince of Denmark, July 28, 1683; and was crowned April 23, 1702.

War was declared against France and Spain, on the 4th of May, by the Queen, the Emperor, and the States-General; but the actions were so numerous, that it would be impossible, in the narrow compass we are here confined to, to mention particularly every engagement.

In 1702, Marlborough led to the field the army of the allies, consisting of 53,000 foot and 2,700 horse. He took, the first campaign, Venlo, Ruremond, Stephensweart, and Liege.

On August 2d, 1704, Marlborough gained a great victory at Blenheim, in which the French had 12000 men killed, and 14,000 made prisoners, among whom was Marshal Tallard, seven generals, and 1,200 other officers, and near 600 squadrons were drowned in the Danube.

Sir George Rook took Gibraltar, after a siege of two days, on July 4, 1704. Next year, Marlborough, with 74,000 men, defeated the French and Bavarians, consisting of 75,960.

The same year, the brave Earl of Peterborough, took Barcelona; and next raised the siege of St. Mattheo, and with 1,200 men obliged 7,000 to fly, took Morviedro, and seized Valencia.

On May 12, 1706, Marlborough, with 59,180 men, attacked the French and Bavarians, 61,120 strong, and, in less than two hours, put their whole army to flight. The enemy had 8,000 killed, 4,000 wounded, and 6,000 taken prisoners.

In 1708, Marlborough and Prince Eugene defeated the whole French army at Oudenard. The French had 4,000 killed and wounded, and 7,000 taken prisoners; while the confederates had only 820 men killed. The duke soon after took Lisle, relieved Brussels, and obliged Ghent to surrender. During these transactions, Major-General Stanhope, with 3,000 men, landed at Minorca, and the whole island was conquered in three weeks, with the loss of only 40 men.

In 1711, the duke took Bouchain, and made the garrison prisoners of war; and this was the last service he performed in the field, who, in the course of ten campaigns, had the honour of receiving ten times the thanks of both houses of parliament; and at last, on the change of ministry, dismissed from all his employments. These wars were at length concluded by the treaty of Utrecht, in 1713.

The animosities of parties, it is thought, shortened the days of the queen, who died at Kensington, Aug. 1, 1714, in the 50th year of her age, having lost her royal consort about six years. She was privately interred in Henry VII's chapel.

In this reign the kingdoms of England and Scotland were united.

GEORGE I.—*From* 1714 *to* 1727.

ON the death of Queen Anne, the privy council gave orders, that the Elector of Hanover should be proclaimed king; and he was crowned on the 11th of October following. His Majesty immediately made several changes in the Ministry; and the Duke of Marlborough was restored to his former posts.

Meanwhile, the pretender asserted his claim to the crown, and it soon appeared that James, the son of James the IId. had a considerable party in England. John Erskine, Earl of Mar, with several other noblemen and gentlemen, assembled at the Brae of Mar; and on September 16, proclaimed the Pretender King, and their numbers soon encreased to 12,000 men. The Earl of Derwentwater and Mr. Forester assembled their friends in Northumberland, and Forester declared the Pretender King at Warkworth. Meanwhile, Lord Viscount Kenmure headed some noblemen and others in the west of Scotland, and at the same time declared the Pretender King at Moffat, in Annandale. Kenmure joined Forester on the borders of Scotland.

At length, M'Intosh, Kenmure, and Forester, marched to Preston in Lancashire; but the Generals Willis and Carpenter, with nine regiments of dragoons, and one of foot, surrounded the place; when Forester submitted, and delivered up all his men prisoners at discretion.

On the 22d of December, the Pretender landed at Peterhead, and was conducted to Fetterosse, where he was proclaimed King. The Duke of Argyle, in January, 1716, obliged the rebels to abandon Perth; from whence they returned to Montrose, where the Pretender privately made his escape to France; upon which General Gordon led them into the mountains, where they were dispersed.

Of the great numbers who were sentenced to die for this rebellion, none were executed except the Lords Derwentwater and Kenmure, and a small number of the lower rank.

In 1718, war was declared against Spain, when Sir George Byng was sent with 21 ships into the Mediterranean; and on July 31, he defeated the Spanish admiral, took ten men of war, and burnt four, and even made the admiral and rear-admiral prisoners. After which, he de-

stroyed seven Spanish men of war, and great quantities of naval stores, on the coast of Sicily and Biscay.

In December, a Spanish squadron, with 10,000 regular troops, under the Duke of Ormond, was sent to invade England; but were dispersed by a violent storm. However, the Marquis of Tullybardine, and the Earl of Seaforth and Marischal, with 307 Spanish soldiers, landed in Scotland, and were joined by 2000 Highlanders: but General Wightman, with 1200 men, on the 10th of June, entirely defeated them.

Lord Cobham then made a descent upon Spain, and took Vigo.

In 1727, his Majesty set out for his German dominions, but was taken ill in his coach on the road to Hanover, and died two days after at his brother's palace at Osnaburgh, on the 11th of June, in the 68th year of his age, and the 13th of his reign, and was interred at Hanover.

King George I. was of a moderate stature; his features were regular and manly, and his countenance grave and majestic. He was an able and experienced general, and a consummate politician.

George II.—*From* 1727 *to* 1760.

As his late Majesty died abroad, his death was not known till the 14th of June, 1727, and his Majesty King George II. was the next morning proclaimed King; and he with his queen were crowned at Westminster, on the 11th of October.

His Majesty found the nation engaged in a war with the Spaniards; but in 1729, a peace was concluded at Seville between Great Britain, France, and Spain.

On October 20, 1739, war was declared by England against Spain; and on November 22, 1740, Admiral Vernon, with six ships took Porto Bello. The next year he was sent with 29 ships of the line, with 10,000 soldiers, under the command of General Wentworth, to attack Carthagena; but though he destroyed six Spanish ships of the line, and seven galleons, the attempt miscarried, through a disagreement between the Admiral and the General.

Commodore Anson sailed from England with five men of war, in 1740; and after having suffered the most dreadful distresses, surprised and took Paita, on the 12th of No-

vember, 1741, and having plundered and burnt the town, and seized several Spanish ship, he, on his return, by the way of the East Indies, took the Manilla galleon, loaded with treasure. He arrived in England, in 1744, with the riches he had acquired from the Spaniards, amounting to about 400,000l.

His late Majesty George the I. powerfully supported the Queen of Hungary's succession to the hereditary dominions of her father the Emperor Charles VI.; and at length Britain and France, under the name of auxiliaries to the contending parties, became principals in the war: when his Britannic Majesty not only furnished 16,000 British troops, but in person headed the allied army in Germany, accompanied by the Duke of Cumberland; and a battle was fought at Dettingen, June 16, 1743, when the King of Great Britain had the glory of the field. The Duke of Cumberland was wounded in the action.

In 1744, war was declared against France; and in 1745, the people of New England, assisted by ten men of war, under Commodore Warren, took Cape Breton, with the loss of only 100 men; but were afterwards obliged to part with it for Madras.

On the 14th of July, the young Pretender sailed for Scotland in a small frigate, and landed there on the 27th of July. He soon obtained a considerable force, and proceeding through several parts of Scotland, had his father proclaimed King, while he himself assumed the title of Prince-Regent. He took several places, and gained some advantages over the king's forces sent against him; but at length the Duke of Cumberland went to Edinburgh, and took the command of the army, and on the 15th of April came to an engagement, near Culloden-house, and obtained a complete victory, in which about 1400 of the rebels were killed, wounded, and taken prisoners, though the royal army had only 60 men killed, and 280 wounded. The Earl of Kilmarnock, Lord Balmerino, Lord Lovet, and Mr. Radcliffe, brother to the late Earl of Derwentwater, were afterwards beheaded on Tower-hill for this rebellion.

Hostilities at length ceased in Flanders, and a general peace was proclaimed in London, February 2, 1749. The French, however, soon broke the peace by erecting forts on the back of the British settlements in America; and in 1754, attempted to seize Nova Scotia: these depredations brought on several engagements, which were attended with various successes.

Meanwhile, the French landed 17,000 men in Minorca, which was defended by General Blackeney. His Majesty declared war against France on the 15th of May, 1756, and sent Admiral Byng, with a strong fleet to the relief of Minorca; but he neglecting to fulfil his instructions, the place was lost, and was tried and shot at Portsmouth.

During these transactions, Colonel Clive distinguished himself in the East Indies; and all the towns and factories belonging to the French on the coast of Coromandel, except only Pondicherry, were in a few years taken by the British.

In 1658, the Duke of Marlborough landing near St. Maloes, in France, burnt many ships, with a great quantity of naval stores. Lieutenant-General Bligh, and Captain (now Lord) Howe, took Cherburgh, and demolished its fortifications. Soon after, Captain Marsh took Senegal, and Commodore Keppel took the island of Goree, on the coast of Africa. On the 26th of July, Cape Breton was again taken by General Amherst and Admiral Boscawen. Soon after, Fort Frontenac surrendered to Lieutenant-General Bradstreet and Fort du Quesne to General Forbes.

On May 1, 1759, the valuable island of Guadaloupe surrendered to the British, and the same month Marigalante, Santos and Desèada, became subject to Britain. And the same year, the French lost Quebec, the capital of Canada.

In 1760, Thurot landing with three frigates in the Bay of Carrickfergus, they were all taken by Captain Elliot; and on September 8, Montreal and all Canada submitted to the British. But after these glorious conquests his Majesty King George II. to the inexpressible grief of his people, died at Kensington, on the 25th of October, in the 77th year of his age, and the next day his present most gracious Majesty was proclaimed King by the name of George III.

GEORGE III.—*From* 1760 *to* 1814.

GEORGE III. who was the eldest son of Frederick, Prince of Wales, succeeded his grandfather, and was proclaimed on the 26th of October, 1760. He was born June 4, 1738.

The beginning of his Majesty's reign was accompanied with great events, the war being carried on with success in every quarter of the world.

On the 8th of September, his Majesty was married at the Royal Chapel, at St. James's, to her Serene Highness the Princess Charlotte, of Mecklenburgh Srelitz; and, on the 22d of September, their Majesties were crowned in the Abbey church of Westminster.

In 1762, war was declared against Spain. This year the British arms were triumphant in all quarters of the globe. The heroes were the Admirals Rodney and Pocock, General Monckton, the Earl of Albemarle, and others.

These successes made our enemies weary of the war, in consequence of which a peace was concluded at Fontainbleau, in February, 1762.

For some few years after the peace, the history of Great Britain is confined almost wholly to domestic transactions. In 1768, Mr. Wilkes, though an outlaw, carried his election for Middlesex: but was afterwards expelled the house of commons, and committed to the King's Bench prison; in consequence of which several riots happened in St. George's fields, and some persons lost their lives. In 1771, his imprisonment expired, when he was chosen one of the sheriffs for London, elected an alderman, afterwards lord mayor, and at last chamberlain of the city.

We must pass over the other domestic disturbances of this year, in order to record those of a more serious nature in North America, where, in 1771, a rebellion broke out, occasioned by new duties being laid on paper, glass, tea, and other articles. The mother country repealed all these duties, except that on tea; and when some ships arrived at Boston, laden with that article, the Bostonians emptied their cargoes into the sea. These proceedings enraging the English Government, an act was passed here for shutting up the port of Boston; and the Americans, on their side, in consequence declared themselves independent of Great Britain.

In 1775, the British and American troops came to blows at Concord, in New England; and several skirmishes afterwards ensued, in which many were killed on both sides, without producing any thing decisive. The Americans began to take up arms in every quarter, and they assumed the title of "The United States of America." They soon after took the garrisons of Ticonderoga and Crown Point, where they found great quantities of military stores.

In 1776, the British government offered terms, which the

Americans disdained. The war was, therefore, carried on with mutual animosity, and the Americans lost all Georgia. In the course of this year, the French entered into an alliance with the Thirteen United States; and soon after, Admiral Keppel engaged the French fleet, commanded by Count D'Orvilliers. Neither side got the victory in this action, and the French were suffered to get off, owing to the misunderstanding between the Admirals Keppel and Palliser.

In 1779, the Spaniards joined the French, took New Orleans on the Mississippi, and laid siege to Gibraltar.

The year 1780 will be ever memorable for one of the most alarming riots that ever happened in the city of London. The King's Bench prison, New Bridewell, the Fleet prison, were all burnt, and the city represented a town taken by storm, by the hands of unmerciful enemies. At length, troops poured into London from all quarters, when tranquillity was restored; no small number of the rioters were shot, some burnt in the flames they themselves had kindled, and many were afterwards tried and executed.

In April, 1782, Admiral Rodney came up with the French fleet, when an engagement took place, and the Ville de Paris, a ship of 110 guns, was taken, with two of 74, and one of 64 guns. A 74 gun ship blew up by accident, soon after she was in our possession, and another of 74 sunk during the engagement. A few days after, two more of the same fleet, of 64 guns, were captured. By this victory the design against Jamaica was frustrated, and Admiral Rodney, on his return, was created a peer. In September the siege of Gibraltar ended in disappointment, and the destruction of almost all the ships and most of the assailants in them.

In 1783, a period was put to this most calamitous war, in which Great Britain lost the best part of her American colonies, besides many thousand valuable lives, and squandered nearly 150 millions of money.

From this period to the year 1787, we have no great political event to record, when the Spaniards seizing an English vessel at Nootka Sound, occasioned a rupture, and both nations made great naval preparations; but the matter was at last ended by a kind of treaty.

The naval armament was hardly dismissed, when the Empress of Russia making heavy claims on the Turks, took

from them Oczakow, Ismael, &c. which alarmed the British court, who fitted out a large fleet; but soon consented to disarm it, and leave the Russians in possession of their conquests.

Soon after, his Majesty was seized with a violent disorder, which was at first thought to be a fever, and continued in that state for several days, with very little hopes of recovery. The parliament met in December, and violent debates passed between the different parties, in order to settle a regency during his Majesty's indisposition. A bill passed the House of Commons for appointing the Prince of Wales Regent, and it was nearly in its last stage in the House of Lords, when his Majesty sent a message to the House, acquainting them of his recovery, and his ability to attend to the public concerns of the nation. The illuminations on this joyful event were such as had never been equalled before in this, or perhaps any city in the world. All ranks and orders, from the peer to the humb'est mechanic, carried their invention and abilities to the utmost stretch.

The 23d of April, 1789, was a day of general thanksgiving. His Majesty went in state to St. Paul's cathedral, preceded by both houses of parliament.

A remarkable revolution happened in France, in July, 1789. The king was deprived of his authority, the Bastile was destroyed, all nobility abolished, and the revenues of the clergy taken from them.

In 1790, disgraceful riots and outrages took place at Birmingham, occasioned by a jealousy arising in those of the established church against the dissenters.

In 1792, a bill passed the House of Commons for the gradual abolition of the slave trade, which was the first step towards putting a period to that horrid traffic; and in 1807, another bill passed the House for finally abolishing that trade.

A proclamation was issued against seditious writings, which caused numerous meetings and addresses, testifying the loyalty of the people.

In the East Indies, a war was carried on against Tippoo Saib, which was successfully terminated by Lord Cornwallis, and the two sons of Tippoo were given as hostages for the performance of the conditions of peace.

The troubles still continuing in France, all the foreign

ambassadors quitted that country. The National Convention decreed, that France is a Republic; and they tried and condemned the king, who suffered death by the guillotine, January 21, 1793; the queen also suffered on the 16th of October following. They declared war against England, Holland, &c. and their minister quitted England.

About this time, Lord Hood took possession of Toulon, by consent of the inhabitants; but not having sufficient force, the Republicans soon obliged him to evacuate it; but he took away and destroyed great part of their fleet. The Duke of York attacked Dunkirk, but was soon obliged to raise the siege.

In 1794, several persons were committed to the Tower on suspicion of high treason, who were afterwards tried and acquitted. At this time the Dutch, through fear, began to treat with France for peace; the Stadtholder fled to England with his family; and the Dutch formed an alliance with the French, and changed the form of their republic. Spain next made peace with France. Both these countries were now exposed to hostilities from England; and in consequence lost several of their colonies, and most of their ships.

Various disturbances broke out in this kingdom amongst the poor, in the year 1795, on account of the dearness of bread. The king was insulted in going to the Parliament House, and something like a bullet discharged at his coach.

In 1796, Lord Malmsbury was sent to negociate a peace with France, but without effect.

The next year an alarming mutiny broke out in the navy, which was quelled, and some of the offenders punished. The negociation was again renewed, and Lord Malmsbury sent to Lisle, but with no better success.

A very serious rebellion broke out in Ireland, in 1798, in which it is said that 25,000 human beings lost their lives, some of them of high consideration. The French landed some troops in that country, who were taken prisoners. They afterwards made another attempt, but their ships were taken by Sir John Warren.

The French sent an expedition, with 40,000 troops to Egypt, and took Malta in their passage; they effected a landing in Egypt, but the English attacked their ships in Aboukir Bay and took all but two, which fled.

Troops with ships, were sent from Russia to assist the English in an expedition to Holland, with a view of driving the French from that country: this object entirely failed; but they succeeded in bringing away the Dutch fleet.

An expedition was sent to Egypt, under General Abercrombie, who made good his landing, and defeated the French; but being wounded in the first battle, he died soon after. The French were sent home prisoners of war.

On the 1st of January, 1801, the union of England and Ireland took place. Malta next surrendered to the English, in consequence of which the Emperor of Russia withdrew from his alliance with Great Britain, and formed a confederacy with the northern powers, about the rights of neutral ships; the English disputed it, and Lord Nelson gained a complete victory over the Danes at Copenhagen.

The English were now left to contend with the French alone, who threatened them with an invasion, and many gun-boats were prepared. Lord Nelson was sent to attack them, which he did after suffering great loss, and without success. Soon after, a new administration was formed, who immediately concluded a peace.

This peace, which is now commonly termed the peace of Amiens, was signed in that city on the 27th March, 1802, between the French republic, the king of Spain, and the Batavian republic, on the one part; and the king of Great Britain and Ireland on the other. In general, the terms were not considered to be such as this country ought to consider an equivalent for all the blood and treasure that she had expended during a twenty years state of hostility; but the subjects of Great Britain were become wearied of a state of warfare, and despairing of being able to subdue the domineering conduct of the ruler of France, they were not disposed to scrutinise very rigorously the terms on which it had been concluded. Great Britain ceded almost all its conquests during the war, except Ceylon and Trinidad. Malta was to be restored to the order of St. John of Jerusalem; and at a stipulated period was, consequently, to be given up by the English who then garrisoned it, and their refusal to fulfil this part of the treaty, became the ostensible pretext for the renewal of hostilities between France and England. Some indignities offered to Lord Whitworth, the British minister, by the first consul of France, who thought proper to affirm, that "England, single-handed

could not contend with France," was considered in the light of insult and defiance, and it determined the British minister not to give up Malta. War being resolved on, both sides adopted martial operations with great promptitude and vigour. Bonaparte threatened the invasion of England, and gun-boats were prepared in great abundance, and collected at Boulogne and other of the French ports, which for some time kept England in a state of unexampled alarm and consternation, during the whole of the year 1803; but after reiterated experiments on the part of France, to navigate them so as to screen them from the vengeance of the British navy, the object was abandoned and the terror that had been excited gradually subsided.

In 1804, Mr. Pitt who had resigned the helm of affairs to Mr. Addington, in order that the peace of Amiens might take place, resumed his station; but from this time such was the unfortunate nature of his administration, that he may be said to have been placed under the influence of an evil angel, and though he continued at his post for about two years, he appeared no longer the same man, all his energies were paralyzed; confidence forsook him; his health declined; and on the 23d of January, 1806, he died, in the 47th year of his age.

In the course of the year 1805, the famous battle of Trafalgar took place, probably the most renowned in the whole annals of British naval glory. On the 19th October, the combined fleets of France and Spain, amounting to 33 sail of the line, of which 18 were French and 15 Spanish, left the harbour of Cadiz, steering towards the straits of Gibraltar. Lord Nelson followed them with the British fleet of 27 ships of the line, and on the 21st came up with them off Cape Trafalgar. The enemy, on his approach, drew up in the form of a crescent, and waited for the English fleet, which bore down in a double column, the gallant commander's last signal being "England expects every man to do his duty." Nobly indeed was it performed; the enemy's line was broken; a close action ensued, which, in about four hours terminated in the capture of *nineteen sail of the combined fleet, with the commander in chief, Villeneuve, and two Spanish Admirals!* But unparalleled as this was in the annals of British victory, it was purchased at an immense expence: we lost 1587 men in killed or wounded, among whom the country had

to deplore that of the gallant commander, who received a mortal wound by a musket-shot from the ship with which he was closely engaged, and died at the moment of declared victory. By this battle of Trafalgar, however, a mortal blow was given to the combined navies from which they never recovered during the war, and which left the British flag complete master of the sea.

On the decease of Mr. Pitt, which took place a few months after the victory of Trafalgar, a new administration was formed. Lord Grenville was made first Lord of the Treasury, and Mr. Fox, Secretary of State for Foreign Affairs. This administration proved but short-lived, owing to the death of Mr. Fox, who did not survive the year; but it is nevertheless memorable for having put a termination to that infernal traffic, the slave trade. The year 1806 was signalized also by the impeachment of Lord Melville, by a committee of the House of Commons. He was tried in Westminster Hall, but acquitted by the Peers, the number of whom that voted was 153. An attempt was also made during Lord Grenville's administration, to grant emancipation to the Irish Catholics; but his Majesty having been persuaded that to remove their disabilities was contrary to his coronation oath, he dissolved the parliament, and chose a new ministry, by which means the bill was got rid of.

The great and avowed object of France at this time, was the ruin of the commerce of England, and subverting her naval superiority; and the undisguised manner in which this was acknowledged, determined the British ministry to counteract it by every means in their power. On the continent of Europe Bonaparte reigned without controul. Spain, Austria, the states of Germany and Prussia were his vassals. At Berlin he issued a decree, declaring the whole of Great Britain in a state of blockade. This gave rise to the Orders in Council, by which the country was so strongly agitated for several years; but the most painful circumstance attending them was the attack upon Copenhagen, which was made by a powerful expedition that this country fitted out, in August 1807, consisting of an army of 20,000 men, and a fleet of 27 sail of the line, besides smaller vessels. Admiral Lord Gambier was entrusted with the command of this expedition; the object of which was to demand the Danish fleet to be given up to Great Britain, to prevent its

falling into the hands of France; and as the Prince Regent of Denmark declined to comply with the British demand, a tremendous fire was opened upon Copenhagen by the bomb-vessels and batteries which the English had constructed, and on the 2d September a general conflagration ensued. The flames were kept up in different places till the evening of the 5th, when a considerable part of the city being consumed, and the remainder threatened with destruction, the city capitulated; the ships were given up to the admiral, viz. 18 of the line, and 15 frigates, besides brigs and gun-boats.

The affairs of Spain began at this time to assume peculiar interest with the people of England. Though in a state of complete and abject vassalage to France, Napoleon marched an army, in the month of March, 1808, into the heart of Spain, and by a dexterous stratagem procured the abdication of the Royal family, whom he sent into exile, and placed his own brother Joseph upon the throne of Madrid. In this sad conjuncture of their affairs, the Spanish patriots who had flown to arms to repel the unprincipled aggressions of France, applied to Great Britain for assistance, and troops were dispatched both to Portugal and Spain to aid the spirit of resistance which had so nobly manifested itself. Sir Arthur Wellesley, (now the Duke of Wellington) commanded the British forces in Portugal, and defeated General Junot, after a severe contest which took place at Vimiera on the 21st August; on this occasion the French lost thirteen pieces of cannon, and 3000 men in killed, wounded, and prisoners. Sir John Moore also received orders to enter Spain in aid of the patriots, and landing his troops at Corunna, he advanced to Salamanca in the month of November, but not meeting with that cordial support from the Spaniards which he was given to expect, and the French forces being powerfully augmented, the gallant General, after manœuvring some time and exerting himself in vain to rouse the Spaniards to action, was compelled to retreat to Corunna, where being closely pressed by Marshal Soult, and unable to reimbark his troops, he prepared to make an attack upon the French army. As this brave officer was in the act of ordering up a detachment of his men to succour that part of the army which was engaged, he received a mortal wound from a cannon ball, and thus fell one of the ablest generals that

our country could boast; a man, who both in his professional and private character had acquired the admiration and esteem of all that knew him.

The British parliament assembled on the 19th January, 1809, and early in the session, a most extraordinary interest was excited in the country, insomuch that for a time it took place of every other topic. Colonel Wardle having adverted to a system of corruption which he said had long prevailed in the military department, made a most pointed attack upon the Duke of York, who filled the office of commander-in-chief, charging him with having suffered himself to be swayed by a kept mistress, whose name was Mary Anne Clarke, and who had carried on a traffic in commissions; affirming that Mrs. Clarke possessed the power of military promotion; that she received pecuniary consideration; and that the Duke of York participated in the benefit arising from such consideration. The members of administration and crown lawyers took fire at these serious charges against one of the royal family, and not supposing it probable that such charges could be made good, in an evil hour they challenged Colonel Wardle to the proof! During the proceedings in this remarkable case, which occupied the greatest part of the months of February and March 1809, and which drew fuller houses than were almost ever known; long and minute examinations were carried on, of persons of both sexes; and disclosures made which might well astonish the country. The result was, that the Duke of York, finding the sense of the independent part of the country decidedly against him, thought it expedient to resign his office of commander-in-chief, and thus terminate all further discussion.

An expedition was fitted out by the British Ministry during this summer, which was long the object of national expectation. About the beginning of May, preparations were made for fitting out the greatest armament, that for a long period had issued from the ports of this island. Towards the end of July, an army of 40,000 men was collected, to be assisted by a fleet of 39 sail of the line, and 36 frigates, besides gun-boats, bomb-vessels, and small craft. The object of this expedition was to gain possession of the islands on the Dutch coast, and destroy the French ships of war, then lying in the River Scheldt. This formidable armament sailed on the 28th

of July, and on the 1st of August, invaded Flushing. A dreadful cannonade and bombardment ensued; the garrison, consisting of 6000 men, surrendered prisoners of war; possession was obtained of the islands of Walcheren and South Beveland, and thus terminated the success of this famous expedition. Its calamities indeed, are not so soon recounted. To the British troops that were left to keep possession of Walcheren, and block up the Scheldt, it proved a most disastrous enterprise. From their position in these low and marshy countries, they soon became sickly; numbers found their grave there, and many more brought back chronic diseases, which long rendered the very name of Walcheren, a subject of terror! After keeping possession of the island till the 23d of December, by which time nearly one half of the British troops left there were either dead or on the sick list, the place was completely evacuated, and thus terminated an expedition which, after a prodigious expence, totally disappointed the public hopes, and what was much worse, exposed the country to the derision of its enemies.

The events of 1810, are not of sufficient interest to claim any very particular attention. The war upon the Peninsula was prosecuted with better success, and Lord Wellington began to distinguish himself as a General, whose military skill reflected honour on the country. In the month of March, Sir Francis Burdett was enabled to account in the House of Commons for writing a political paper, in which he had "denied the power of that house to imprison the people of England," and avowing himself the writer of it, he was committed to the Tower, where he remained a prisoner till the parliament was prorogued. Sir Francis brought actions against the Speaker of the House of Commons for issuing his warrant; against the Serjeant at Arms for executing it; and against the Constables of the Tower for keeping him in custody, but he failed in each of them, on the plea of the legality of the warrants.

The close of the year 1810, was marked by the recurrence of a domestic calamity, which produced a change in the government that forms an era in the annals of the country. His Majesty, in consequence, as it is supposed, of deep affliction, excited by the death of his youngest daughter, the Princess Amelia, was again attacked by the

mental malady, under which he had formerly laboured; and it was found necessary to supply the deficiency in the executive branch of government by a Regency, which was now vested in His Royal Highness the Prince of Wales.

The regency bill gave rise to considerable discussions in the House of Commons, and occupied its attention so long that it was not finally passed into a law till the 5th of February, 1811. In the mean time, the country was beginning to experience increasing difficulties in the way of its commerce. The fact of a real diminution of the value of Bank Notes in comparison of Bullion, at length became so notorious as to excite alarm, and parliament was occupied with discussions upon the subject through the greatest part of the session, and pamphlets and volumes were written to elucidate this difficult question, which after all that has been said and written, remains precisely where it before was.

Among the domestic occurrences of this year, we may notice the second enumeration of the population of the Kingdom of Great Britain, and its general result. In 1801, the return had been 10,942,646; that of 1811, was 12,552,144, exhibiting an increase of 1,611,882, of which almost every town and district numbered had a proportionate share; and when we reflect that these ten years were a time of war, the increase appears very remarkable.

The office of Chancellor of the Exchequer, from the period of the dissolution of Lord Grenville's short administration, had been filled by Mr. Percival, who though not a first rate man in point of talents, was not deficient in application and industry, while in debate he sometimes rose considerably above mediocrity. As this gentleman was entering the lobby of the House of Commons on the 11th of May, 1812, about five in the evening, a person of the name of Bellingham, who had been waiting his arrival, fired a pistol at him, the ball of which entered his left breast and pierced his heart. He staggered, fell, and in a few moments expired. Nothing could surpass the consternation which prevailed in both houses of Parliament at this catastrophe. The first impression was that a conspiracy existed against the whole administration; but when the panic had subsided, it was found that the act was merely in revenge of a supposed private injury.

The commercial relations between Great Britain and

America, had now, in consequence of our orders in council, been in a very critical state for several years, and the temper of the government of the United States, at the commencement of this year, (1812,) rendered it manifest that a war between the two countries was inevitable. The spring passed, on the part of the Americans, in the discussion of various measures of preparation by the Congress, in which the war-party displayed a manifest preponderance. An embargo was laid on all the shipping in the United States for the term of 90 days, on the 1st of June, the President sent a long message to both houses of Congress, recapitulating the various acts of provocation received from England, and a few days afterwards, laid before them copies of the correspondence between Mr. Foster, and Mr. Munroe, the result of which was, that on the 18th of June, an Act was passed declaring *the actual existence of war*, between the United States and Great Britain.

It is now proper to revert to the state of the war in the Peninsula. In the beginning of the year 1811, Marshall Soult having obtained considerable reinforcements, invested Olivença, and on the 27th of January, after the batteries had begun to play, the garrison consisting of 4,500 men, surrendered prisoners of war. The French army then besieged Badajos, which it pressed so closely, that on the [illegible] of March, the governor capitulated, and the garrison of 7000 surrendered prisoners of war. These events were a source of great chagrin to Lord Wellington, who, referring to them in one of dispatches, says, "The Spanish Nation has lost in the course of two months, the fortresses of Fortosa, Olivença, and Badajos, without any sufficient cause, while Marshal Soult, with a corps of troops not exceeding 20,000, besides the capture of the two last places, has made prisoners and destroyed above 22,000 Spanish troops." But the tide of affairs from this time turned rapidly in favour of the British arms. Lord Wellington, early in the spring of 1812, invested Ciudad Roderigo, and took it, making the garrison of 1700 men prisoners of war. The next object of the British General was Badajos, which he invested on both sides, and compelled it to surrender with a garrison of 5000 men. Soult on this, retreated towards Andalusia. General Graham was dispatched in pursuit of him, and coming up with the French cavalry, he routed them with

considerable loss. These brilliant successes were followed up perseveringly throughout the whole of this campaign, and Lord Wellington may be regarded as having the whole of the Peninsula under his military care.

It was not, however, till late in the month of May, 1813, that Lord Wellington was enabled by the recovery of his sick, and the arrival of reinforcements from England, to move from his winter quarters at Freynada, and march to Salamanca. On their approach, the French army retreated from the Tagus and Madrid, and on the 4th of June had evacuated Valadolid. Making a stand at Bengos, they evinced a disposition to defend the castle, but changing their purpose, they destroyed the fortifications, and the whole army retreating through Bengos, marched towards the Ebro. Crossing that river on the 14th and 15th of June, they marched upon Vittoria. Here they mustered all their force, and made a formidable stand; a severe action ensued, which ended in favour of the British, who drove the French from all their intrenchments, and their retreat became so rapid that they were unable to carry off their artillery and baggage, the whole of which, consisting of 151 pieces of cannon, and 415 waggons of stores fell into the hands of the allies. Such was the battle of Vittoria, which added new laurels to the illustrious General.

From this time the issue of the contest was no longer problematical. The French retired by Pampeluna, and re-entered their own country into which the British army followed them. On the 25th February, 1814, Lord Wellington advanced through a strong country intersected with rivers, in the face of an active and vigilant foe, penetrating to the neighbourhood of Bourdeaux. In the mean time similar success had attended the arms of Russia, Austria, and Prussia, in the north of Europe, so that the fate of Napoleon became every day more ominous. The hostile armies penetrated to the heights of Paris, where the French army took up a strong defensive position, having 150 pieces of cannon ranged in line for the protection of the city. On the 30th March an attack was made by the allies, and though the resistance was obstinate, the heights were carried. The losses of the French induced them to send out a flag of truce, proposing a cessation of hostilities. On the 11th April, a treaty between the allied powers and Bonaparte was

signed at Paris; the latter renounced the sovereignty of France and Italy, and consented to retire for the remainder of his days, to the island of Elba, on the coast of Tuscany.

Louis XVIII. who had for several years taken refuge in England, now returned to France, hoping to establish his hereditary claim to the throne of his ancestors. But not a year had elapsed before Napoleon Bonaparte was again in the heart of France, and at the head of his devoted troops. On the 26th February, 1815, he crossed the sea, under the shade of evening, from the island of Elba, and on the 1st March anchored at the small port of Cannes in Provence. With a handful of attendants he marched to Grenoble. Here the 7th regiment of the line marched out and joined him. The garrison opened its gates to him, and the magazines of the city were placed at his disposal. When intelligence of these things reached Paris, it threw the court into the utmost consternation, and they saw the necessity of providing for their safety by retiring into the Netherlands, first to Lisle and then to Ghent. In a few months, however, the combined armies were again in motion; they proceeded to rendezvous in the Netherlands; the battle of Waterloo ensued, and decided once more the destiny of Napoleon, who was sent to the island of St. Helena, where 'tis probable that due attention will be paid to prevent him from returning to disturb the peace of Europe.

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...ORD'S PRAYER

SUPPLEMENT.

CONTAINING

STENOGRAPHY, or SHORT-HAND.

THE art of stenography, or short-writing, was known and practised by most of the ancient civilized nations. The Egyptians, who were distinguished for learning at an early period, at first expressed their words by a delineation of figures called *hieroglyphics*. A more concise mode of writing seems to have been afterwards introduced, in which only a part of the symbol or picture was drawn. This answered the purpose of short-hand in some degree. After them the Hebrews, the Greeks, and the Romans, adopted different methods of abbreviating their words and sentences, suited to their respective languages. The initials, the finals, or radicals, often served for whole words; and various combinations of these sometimes formed a sentence. Arbitrary marks were likewise employed to determine the meaning, and to assist legibility; and it seems probable that every writer, and every author of antiquity, had some peculiar method of abbreviations calculated to facilitate the expression of his own sentiments, and intelligible only to himself.

It is also probable, that some might by these means take down the heads of a discourse or oration; but few, very few, it is presumed, could have followed a speaker through all the meanders of rhetoric, and noted with precision every syllable, as it dropt from his mouth, in a manner legible even to themselves. To arrive at such consummate perfection in the art was reserved for more modern times, and is still an acquisition by no means general.

In every language of Europe, till about the close of the 16th century, the Roman plan of abbreviating (viz. substituting the initials of radicles, with the help of arbitraries, for words) appears to have been employed. Till then no regular alphabet had been invented expressly for stenography, when an English gentleman of the name of *Willis* invented and published one. His plan was soon altered and improved, or at least pretended to be so. One alteration succeeded another: and at intervals, for a series of years past, some men of ingenuity and application have composed and published systems of stenography, and

signed at Paris; the latter renounce France and Italy, and consented to mainder of his days, to the island of Tuscany.

Louis XVIII. who had for several in England, now returned to France, his hereditary claim to the throne of not a year had elapsed before Napol again in the heart of France, and at voted troops. On the 26th February the sea, under the shade of evening. Elba, and on the 1st March anchored Cannes in Provence. With a handfu marched to Grenoble. Here the 7 line marched out and joined him. Th its gates to him, and the magazines of th at his disposal. When intelligence reached Paris, it threw the court into nation, and they saw the necessity of safety by retiring into the Netherland then to Ghent. In a few months, how armies were again in motion; they dezvous in the Netherlands; the bat sued, and decided once more the who was sent to the island of St. Hel bable that due attention will be p from returning to disturb the peace

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expressed by the simplest characters, which will be found perfectly easy in their application.

The arbitraries are few in number, and the arbitrary abbreviations, as they are entirely from the letters of the alphabet, and chosen from some thousand of words in common use, will well repay the learner or an hour's trouble in committing them to memory.

In the last section is laid down a scheme of abbreviation, comprised in a few rules, perfectly easy to be understood and practised by proficients in this art, which we hope will be found free from the perplexity complained of in many systems where abbreviation is admitted. The principal rules are new, and are so easy, so extensive in their use, and so consistent with expedition and legibility, if applied with judgment, that they alone might suffice. The learner is however advised by no means to adopt any of them, till experience has convinced him that they may be used without error or injury to legibility. All abbreviating rules ar suited to those only who have made some progress in the stenographic art; for although they certainly promote expedition in a wonderful manner, and afford the greatest ease to a proficient, yet a learner, as expedition is not his first, though his ultimate view, should admit of nothing that in the least renders the reading difficult.

Of the Principles of Stenography.

The English alphabet consists of 26 letters; six of which are vowels, as every school-boy knows.

This alphabet, as is observed by the best grammarians who have written on the language, is both defective and redundant in expressing the various modifications of sound. But all modern alphabets are equally, and some more anomalous in these respects.

But as it is not our intention to propose a mode of spelling different from that in common use, when applied to printing or long-hand writing, we shall only observe, that in stenography, where the most expeditious and concise method is the best, if consistent with perspicuity, the following simple rules are studiously to be practised.

RULE I. All quiescent consonants in words are to be dropped; and the orthography to be directed only by the pronunciation; which being known to all, will render this art attainable by those who cannot spell with precision in long-hand.

Rule II. When the absence of consonants, not entirely dormant, can be easily known, they may often be omitted without the least obscurity.

Rule III. Two or sometimes more consonants may, to promote greater expedition, be exchanged for a single one of nearly similar sound; and no ambiguity as to the meaning ensue.

Rule IV. When two consonants of the same kind or same sound come together, without any vowel between them, only one is to be expressed; but if a vowel or vowels intervene, both are to be written; but if they are perpendicular, horizontal, or oblique lines, they must only be drawn a size longer than usual; and characters with loops must have the size of their heads doubled.

Might is to be written *mit*, fight *fit*, machine *mashin*, enough *enuf*, laugh *laf*, prophet *profet*, physics *fisiks*, through *thro*, foreign *foren*, write *rite*, wright *rit*, island *iland*, knavery *navery*, temptation *temtation*, knife *nife*, stick *stik*, thigh *thi*, honour *onour*, indictment *inditement*, acquaint *aquaint*, chaos *kaos*, &c.

Strength *strenth*, length *lenth*, friendship *frenship*, connect *conek*, commandment *comanment*, conjunct *conjunt*, humble *humle*, lumbor *lumer*, slumber *slumer*, number *numer*, exemplary *exemlary*, &c.

Rocks *rox*, acts *aks* or *ax*, facts *faks* or *fax*, districts *distriks* or *distrix*, affects *afeks* or *afex*, afflicts *afliks* or *aflix*, conquer *konkr*, &c.

Letter *leter*, little *litle*, command *comand*, error *eror*, terror *teror*, &c. But in *remember*, *moment*, *sister*, and such like words, where two consonants of the same name have an intervening vowel, both of them must be written.

These four rules, with their examples, being carefully considered by the learner, will leave him in no doubt concerning the disposition and management of the consonants in this scheme of short-writing: we shall therefore proceed to lay down rules for the application of the vowels with ease and expedition.

Rule I. Vowels, being only simple articulate sounds, though they are the connectives of consonants, and employed in every word and every syllable, are not necessary to be inserted in the middle of words; because the consonants, if fully pronounced, with the assistance of connection, will always discover the meaning of a word, and make the writing perfectly legible.

Rule II. If a vowel is not strongly accented in the

incipient syllable of a word, or if it is mute in the final, it is likewise to be omitted; because the sound of the incipient vowel is often implied in that of the first consonant, which will consequently supply its place.

RULE III. But if the vowel constitutes the first or last syllable of a word, or is strongly accented at its beginning or end, that vowel is continually to be written.

RULE IV. If a word begins or ends with two or more vowels though separated, or when there is a coalition of vowels, as in diphthongs and triphthongs, only one of them is to be expressed, which must be that which agrees best with the pronunciation.

RULE V. In monosyllables, if they begin or end with a vowel, it is always to be inscribed, unless the vowel *e* be mute at the end of a word.

Such are the general principles of this art; in vindication and support of which it will be needless to offer any arguments, when it is considered that brevity and expedition are the chief objects, if consistent with legibility; and the subsequent specimens in the orthography recommended will, we hope, be sufficient to show that there is no real deficiency in the last mentioned particular.

He who md us mst be etrnl, grt, nd omnptnt. It is ur dty, as rasnl bngs, to srv, lv, and oby hm. A mn tht wd avd blm, shd be strktly jst in al hs actns, nd nvr wsh al hs nbrs to ple evry bdy. I wd nt frm any knctn wth a mn who hd no rgrd fr hmslf; nthr wd I blv a mn who hd once tld me a li. Hnr is of al thngs the mst dfclt to prsrv untarnshd; nd whn once impchd, lk the chstty of a wmn, nvr alns wth its wntd lstr. With gd mnrs, kmplsns nd an esy plt adrs many mk a fgr in the wrld, whs mntl ablts wd skrsly hv rsd thm abv the rnk of a frmn. Idlns is the prnt of a thsnd msfrtns, wch ar nvr flt by the ndstrs: it is a sin and a pnshmnt of itslf, nd brngs wnt and bgry in its trn. Vrtu is the frst thng tht shd be rgrdd; it is a rwrd of itslf; mks a mn rspktbl hr, nd wl mk hm etrnly hpy hrftr. Prd is a mst prnes psn, wch yt ws plntd by hvn in ur nts, to rs ur emlsn to imtt grt nd wrthy ktkts and actns, to st in us a [illegible] wht is et nd grt, nd a [illegible] ndgnsn gnst oprsrs nd wkrs of any knd of nkty: In shrt to mk us st a prpr vlu upon urslvs, nd dspis a wthls flo, h evr shtd. The fr prd is a vrtu, nd my gntly be kld a grtns of sl. Bt prd, like othr pasns, gnrly rns upn rng objks, or is apld in rng prprsns. Hu bas is it to se a rch whm evry vs he emld mrbld, nd evry fly bntmbld, vlng hmslf on his hi brth. nd hvng the ilstrs nmtrs,

of whm he nbrts nthng bt the nm or ttl! nastrs who if thy nu hm, wd dsn thr dpndnt wth kntmt. But al prd of the art is fly, nd evr to be avdd.

Of the Stenographic Alphabet.

As the whole of this art depends upon a regular method and a simple alphabet, we have not only endeavoured to establish the former on satisfactory principles, but have been careful to appropriate, according to the comparative frequency of their occurrence, such characters for the letters as, after repeated trials and alterations, were conceived to be the best adapted for dispatch.

The stenographic alphabet consists of 18 distinct characters (viz. two for the vowels and the rest for the consonants), taken from lines and semicircular curves; the formation and application of which we shall now explain, beginning with the vowels.

For the three first vowels, *a*, *e*, and *i*, a comma is appropriated in different positions; and for the other three, *o*, *u*, and *y*, a point. The comma and point, when applied to *a* and *o*, is to be placed, as in Alphabet Plate, at the top of the next character; when for *e* and *u*, opposite to the middle; and when for *i* and *y*, at the bottom.

This arrangement of the vowels is the most simple and distinct that can easily be imagined. Places at the top, the middle, and the bottom of characters, which make three different positions, are as easily distinguished from one another as any three separate characters could be; and a comma is made with the same facility as a point.

Simple lines may be drawn four different ways; perpendicular, horizontal, and with an angle of about 45 degrees to the right and left. An ascending oblique line to the right, which will be perfectly distinct from the rest when joined to any other character, may likewise be admitted. These characters being the simplest in nature, are assigned to those five consonants which most frequently occur, viz. *l*, *r*, *t*, c hard or *k*, and *c* soft or *s*.

Every circle may be divided with a perpendicular and horizontal line, so as to form likewise four distinct characters. These being the next to lines in the simplicity of their formation, we have appropriated them for *b*, *d*, *n*, and *m*

The characters expressing nine of the consonants are all

perfectly distinct from one another; eight only remain which are needful; viz. *f*, *g*, or *j*, *h*, *p*, *q*, *v*, *w*, and *x*. To find characters for which we must have recourse to mixed curves and lines. The characters which we have adopted are the simplest in nature after those already applied, admit of the easiest joining, and tend to preserve lineality and beauty in the writing.

It must be observed that we have no character for *c* when it has a hard sound, as in *castle;* or soft, as in *city;* for it always has the sound of *k* or *s*, which in all cases will be sufficient to supply its place: or *c* being easier written, might be used in all cases for the hard sound.

R likewise is represented by the same character as *l*, only with this difference, *r* is written with an ascending stroke and *l* with a descending; which is always to be known from the manner of its union with the following character; but in a few monosyllables where *r* is the only consonant in the word, and consequently stands alone, it is to be made as is shown in the alphabet for distinction's sake. The character for *h*, when lineality requires it, may be made from the bottom and inverted: And often *h* may be omitted entirely.

Z, as it is a letter seldom employed in the English language, and only a coarser and harder expression of *s*, may be supplied by *s* whenever it occurs; as for *Zedekiah* write *Sedekiah*, &c. or *z* itself may be used.

Of the Prepositions and Terminations.

The prepositions and terminations in this scheme are so simple, that the greatest benefit may be reaped from them, and very little trouble required to attain them; as the incipient letter or the incipient consonant of all the prepositions and of several of the terminations is used to express the whole. But although in the Plate sufficient specimens are given of the manner of their application, that the learner of less ingenuity or more slow perception may have every assistance, we have subjoined the following directions.

RULE I. The preposition is always to be written without joining, yet so near as plainly to show what word it belongs to; and the best way is to observe the same order as if the whole was to be connected.

RULE II. A preposition, though the same letters that constitute it may be met with in the middle or end of a word, is never to be used, because it would expose to obscurity.

Rule III. Observe that the preposition *omni* is expressed by the vowel *o* on its proper position; and for *anti*, *unta*, *ante*, by the vowel *a*, which the radical part of the word will easily distinguish from being only simple vowels.

The first rule for the prepositions is (allowing such exceptions as may be seen in the plate) to be observed for the terminations; and also the second *mutatis mutandis;* except that whenever *sis*, *sus*, *sys*, *cious*, *tious*, and *ces* occur, they are to be expressed as directed in the fourth rule for the consonants, whether in the beginning, middle, or end of words. But in a few words where three horizontal characters meet, it will be better to express the *fis*, &c. by the semielliptical character in the Plate opposite *tious*.

Rule IV. The terminative character for *tion*, *sion*, *cion*, *cian*, is to be expressed by a small circle joined to the nearest letter, and turned to the right; and the plurals *tions*, *sions*, *cions*, *cians*, *rians*, *tienee*, by a dot on the same side

Rule V. The terminative character for *ing*, is to be expressed likewise by a small circle, but drawn to the left hand; and its plural *ings* by a dot. In horizontal characters, by the left hand is meant the top, and by the right the space below the letter. In all other chararctes the right and left positions cannot be mistaken.

Rule VI. The plural sign *s* is to be added to the terminative characters when necessary.

Rule VII. The separated terminations are never to be used but in polysyllables or words of more syllables than one.

These rules duly observed will point out a method as concise and elegant as can be desired, for expressing the most frequent and longest prepositions and terminations in the English language. If it should be thought necessary to increase their number by the addition of others, it will be an easy matter for any one of the least discernment to do so, by proceeding on the principles before laid down.

Rules for Abbreviations.

Though a more concise method of writing, or more numerous abbreviations, may not be indispensably necessary, if the foregoing directions be practised for a considerable time, yet contractions will be found extremely useful and convenient to those who have attained a proper knowledge of the subject, and lead to a greater degree of expedition, at the same time that they diminish the labor of writing.

It has been observed in the introduction, that abbreviations are only to be employed by proficients in this art; because expedition is not the first, though the ultimate, object in view: and that an easy legibility is of the utmost consequence to the learner; which, however, cannot be preserved, if he adopts too soon those very rules which in time will afford him the greatest ease when applied with judgment.

The following short and practical rules will be found fully adequate to every purpose for which they were intended, and are far superior in the facility of their application to any which we have seen.

RULE I. The usual abbreviations in long-hand are always to be followed; as Mr. for Master, M. D. for Doctor of Physic, and Abp. for Archbishop.

RULE II. Substantives, adjectives, verbs, and participles, when the sense will direct to the meaning, are to be expressed by their initial consonant with the distinguishing marks exhibited in the Alphabet Plate, viz. a substantive must have the dot exactly over its initial consonant; an adjective must have a dot under it; a verb is to be expressed by a comma over its initial consonant; and a participle by a comma under. The dot or comma being placed thus will never occasion them to be mistaken for vowels, because they should always be on one side or other; whereas the mark for parts of speech must constantly be placed exactly over or under. These being the four principal parts of speech will be sufficient; and an adept will never be at a loss to know when he can with safety apply this rule to them.

RULE III. To render the writing more legible, the last letter of the word may be joined to the first, and the proper mark applied.

RULE IV. The constituent or radical part of words, especially if they are long, will often serve for the whole, or for sometimes the first syllable; as, we ought to moderate our *ex.* by our *circum.*; a man's *man.* commonly shape his *for*

RULE V. All long words without exception may have their prepositions or terminations expressed by the incipient consonant of such preposition or termination.

RULE VI. When there is a great dependence between the parts of a sentence, the initial letter will often suffice; as *L.* is the capital of Great B.; the eldest S. of the king of *G. B.* is styled *P.* of *W.* Every one, it is presumed, will allow this to be perfectly legible either in long or short-hand.

RULE VII. The terminations *ness* and *less* may be omitted; as *faithfulness* is only to be written *faithful*; *forwardness*, *forward*; *heedless*, *heed*; *stubbornness*, *stubborn*, &c.

RULE VIII. The second and third persons of verbs, ending in *eth* and *est* may be expressed by *s*; as, he *loves*, thou *teaches*; instead of he *loveth*, thou *teachest*: or even without *s*; as, he *love*, &c.

RULE IX. Words naturally supplied by the sense may often be entirely omitted, and yet no ambiguity ensue; as, *In beginning God created heaven and earth*, for in the beginning God created *the* heaven and *the* earth.

RULE X. When there is an immediate repetition of a sentence or word, a line is to be drawn under the sentence or word to be repeated; as, Amen, Amen, is to be written *Amen*; but if any words intervene before a word or sentence is to be repeated, the line must be drawn as before, and ^ or mark of omission placed where the repetition should begin; as, *Is it just the innocents should be* condemned ^ reviled?

THE CONTENTS OF THE STENOGRAPHIC PLATES

Fabricius's Reply to Pyrrhus.

As to my poverty, you have indeed, Sir, been rightly informed. My whole estate consists in a house of but mean appearance, and a little spot of ground, from which by my own labour I draw my support. But if by any means you have been persuaded to think, that this poverty makes me less considered in my country, or in any degree unhappy, you are extremely deceived. I have no reason to complain of fortune, she supplies me with all that nature requires; and if I am without superfluities, I am also free from the desire of them. With these I confess I should be more able to succour the necessitous, the only advantage for which the wealthy are to be envied; but as small as my possessions are, I can still contribute something to the support of the state and the assistance of my friends. With regard to honors, my country places me, poor as I am, upon a level with the richest; for Rome knows no qualifications for great employments but virtue and ability. She appoints me to officiate in the most august ceremonies of religion; she entrusts me with the

command of her armies; she confides to my care the most important negotiations. My poverty does not lessen the weight and influence of my counsels in the senate; the Roman people honour me for that very poverty which you consider as a disgrace; they know the many opportunities I have had in war to enrich myself without incurring censure; they are convinced of my disinterested zeal for their prosperity; and if I have any thing to complain of in the return they make, it is only the excess of their applause. What value then can I set upon your gold and silver? What king can add any thing to my fortune? Always attentive to discharge the duties incumbent on me, I have a mind free from self reproach, and I have an honest fame. *Dodsley's Preceptor.*

Letter to a Friend against Waste of Time.

Converse often with yourself, and neither lavish your time, nor suffer others to rob you of it. Many of our hours are stolen from us, and others pass insensibly away; but of both these losses the most shameful is that which happens through our own neglect. If we take the trouble to observe, we shall find that one considerable part of our life is spent in doing evil, and the other in doing nothing, or in doing what we should not do. We don't seem to know the value of time, nor how precious a day is, nor do we consider that every moment brings us nearer our end. Reflect upon this, I entreat you, and keep a strict account of time. Procrastination is the most dangerous thing in life. Nothing is properly ours but the instant we breathe in, and all the rest is nothing; it is the only good we possess; but then it is fleeting, and the first moment robs us of it. Men are so weak, that they think they oblige by giving of trifles, and yet reckon that time as nothing for which the most grateful person in the world can never make amends. Let us therefore consider time as the most valuable of all things, and every moment spent, without some improvement in virtue or some advancement in goodness, as the greatest sublunary loss. *St. Paul's Speech before Agrippa and Festus.* See Acts, xxvi. 1-29.

FINIS.

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